BACHELOR THESIS – ME 141502

FEASIBILITY STUDY OF LONG LINER FISHING VESSEL WITH FRP CONSTRUCTION IN CILACAP DISTRICT CENTRAL JAVA

MOCHAMMAD GRIZHALDO AZRANDA JUNIOR
NRP. 4213 101 036

Supervisors :
Taufik Fajar Nugroho, S.T., M.Sc.
Ir. Dwi Priyanta, M.SE

DOUBLE DEGREE PROGRAM OF
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Institut Teknologi Sepuluh Nopember
Surabaya 2017

APPROVAL FORM

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Proposed to Fulfill One of The Requirements for Obtaining a Bachelor Engineering Degree
on
Reliability, Availability, Management and Safety (RAMS) Laboratory
Study Program Bachelor Double Degree of Marine Engineering Department
Faculty of Marine Technology
Institut Teknologi Sepuluh Nopember Surabaya

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SURABAYA
July, 2017

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Department : Double Degree Program in Marine Engineering

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FEASIBILITY STUDY OF LONG LINER FISHING VESSEL WITH FRP CONSTRUCTION IN CILACAP DISTRICT CENTRAL JAVA

Name	**: Mochammad Grizhaldo Azranda Junior**
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ABSTRACT

Fishery is a unit determined by an authority or other entity that is engaged in raising and/or harvesting fish. Cilacap district has a great sea fishery potential but the fishery potential in sea territorial of Cilacap has not to be maximized yet. Fiberglass Reinforcement Plastic (FRP) on lately received attention among shipbuilding experts as material to build a ship, indicating that the vessel which made of fiberglass materials increased in the making. The use of fiberglass raw material widely used in shipbuilding such as speed boats, patrol boats, fishing boats, and cruises. Long liner method is a passive fishing method which uses the floated main line. This thesis purposes is to analyze the investment feasibility for long liner fishing vessel with FRP construction in Cilacap District viewed from the size of vessel and profit which can be obtained, so that could giving the figure of economic value started from ship building cost, ship operational cost, ship profit average per year, and financial factor of investment. From the data which has been collected and processed from 2010 – 2014 of long liner fishing vessel productivity, during five years the average of tuna productivity in fishing port PPS Cilacap shown that Big Eye Tuna had the highest average of productivity amount with catch effort 156,26 trips and the productivity level was 14787,8 ton and the lowest average of productivity was Southern Bluefin Tuna with catch effort 1,738 trips and the productivity level was solely 47,59 ton. Total project cost needed for ship building of MV. Inka Mina 438 is Rp 1,514,915,050. Approximately projected 70% will be loaned by financial company such as bank and 30% will be self-funded. Fishing activities using long liner fishing gear during 5 years period are generating average profit Rp 440,063,138 and the average profit margin is 17.64%. By comparing the expenditure for fixed cost with variable cost and total revenue, then Break Even Point for this investment occur when the average sales is Rp 944,622,704 or 23,565 kg. The Investment of long liner fishing vessel assessed by using any assumptions and parameters will resulting of NPV Rp

568,394,954 when the interest rate is 12%. The value of IRR is 23%, Net B/C Ratio is 1.07 and the Payback Period reached in 4.4 years. There are 3 scenarios for sensitivity analysis of investment which considering the variable cost rises, income down, and combination of them.

Keyword : Feasibility study, long liner fishing vessel, investment, financial analysis

STUDI KELAYAKAN KAPAL IKAN *LONG LINER* DENGAN KONSTRUKSI FRP DI KABUPATEN CILACAP JAWA TENGAH

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ABSTRAK

Perikanan adalah unit yang ditentukan oleh pihak berwenang yang bergerak dalam pengembangan ikan. Kabupaten Cilacap memiliki potensi perikanan laut yang besar namun potensi perikanan di wilayah laut Cilacap belum maksimal. Fiberglass Reinforcement Plastic (FRP) akhir-akhir ini mendapat perhatian di kalangan ahli pembuatan kapal sebagai bahan untuk membangun sebuah kapal, ditunjukkan dengan kapal yang terbuat dari bahan fiberglass meningkat dalam pembuatannya. Penggunaan bahan baku fiberglass banyak digunakan di galangan kapal seperti speed boat, kapal patroli, kapal nelayan, dan kapal pesiar. Metode long liner adalah metode pasif memancing yang menggunakan jalur utama yang mengambang. Tujuan penulisan ini adalah untuk menganalisis kelayakan investasi kapal penangkap ikan long liner dengan konstruksi FRP di Kabupaten Cilacap dilihat dari ukuran kapal dan keuntungan yang dapat diperoleh, sehingga dapat memberikan gambaran nilai ekonomis mulai dari biaya pembangunan kapal, biaya operasional kapal, rata-rata keuntungan kapal per tahun, dan faktor keuangan investasi. Dari data yang telah dikumpulkan dan diolah dari tahun 2010 sampai 2014 produktivitas kapal penangkap ikan panjang, selama lima tahun rata-rata produktivitas tuna di pelabuhan perikanan PPS Cilacap menunjukkan bahwa Big Eye Tuna memiliki jumlah produktivitas rata-rata tertinggi dengan usaha tangkapan 156, 26 trips dan tingkat produktivitas 14787,8 ton dan Rata-rata produktivitas terendah adalah tuna sirip biru selatan dengan usaha tangkapan 1.738 trips dan tingkat produktivitas hanya 47.59 ton. Total biaya proyek yang dibutuhkan untuk pengembangan kapal MV. Inka Mina 438 adalah Rp 1.514.915.050. Kira-kira diproyeksikan 70% akan dipinjamkan oleh perusahaan keuangan seperti bank dan 30% akan didanai sendiri. Kegiatan penangkapan ikan dengan menggunakan alat tangkap long line selama 5 tahun menghasilkan keuntungan rata-rata Rp 440.063.138 dan margin keuntungan rata-rata adalah 17,64%. Dengan membandingkan pengeluaran untuk biaya tetap

dengan biaya variabel dan total pendapatan, maka Break Even Point untuk investasi ini terjadi bila rata-rata penjualannya adalah Rp 944.622.704 atau 23.565 kg. Investasi kapal penangkap ikan long liner yang dinilai dengan menggunakan asumsi dan parameter akan menghasilkan NPV Rp 568.394.954 bila tingkat bunga 12%. Nilai IRR adalah 23%, Net B / C Ratio adalah 1,07 dan Payback Period mencapai 4,4 tahun. Terdapat 3 skenario analisis sensitivitas investasi yang mempertimbangkan kenaikan biaya variabel, turunnya pendapatan, dan kombinasi keduanya.

Kata kunci: Studi kelayakan, kapal penangkap ikan long liner, investasi, analisis keuangan

PREFACE

Alhamdulillahirobbil 'alamin. Praise is merely to the Almighty Allah SWT for the gracious mercy and tremendeous blessing which enables the author to accomplish this bachelor thesis.

This thesis report entitled "Feasibility Study of Long Liner Fishing Vessel with FRP Construction in Cilacap District Central Java" is submitted to fulfill one of the requirements in accomplishing the bachelor degree program at Marine Engineering Department, Faculty of Marine Technology, Institut Teknologi Sepuluh Nopember Surabaya. Conducting this research study is not possible without all helps and supports from various parties. Therefore, the author would like to thank to all people who has support the author for accomplishing this bachelor thesis, among others :

1. Firstly, to my parents, Mr. Drs. Mochammad Azis Yusup and Mrs. Ratih Herwandari Chusnawati who always give their loves, prayers, supports, and encouragements for every single path the author chooses. In addition, my beloved brother Mochammad Axel Zisranda Junior and my beloved sister Grizhelda Nayla Munnazhah Azdara.
2. Mr. Dr. Eng. Muhammad Badrus Zaman, ST., MT. as the Head of Marine Engineering Department
3. Mr. Prof. Semin, ST., MT., Ph.D as the Secretary of Marine Engineering Department
4. Mr. Sutopo Purwono Fitri, ST., M.Eng., Ph.D as Author's Academic Advisor since first semester until eighth semester
5. Mr. Taufik Fajar Nugroho, ST., M.Sc. as Author's Thesis Supervisor who has giving the ideas, correction, and guidance during the thesis is conducted.
6. Mr. Ir. Dwi Priyanta, M.SE as Author's Thesis Co-Supervisor and Secretary of Double Degree Program in Marine Engineering Department who has giving the motivation and every necessary information to help finish the bachelor thesis.
7. Mr. A.A. Bagus Dinariyana Dwi P., ST., MES., Ph.D as the Head of RAMS Laboratory who has giving permission to do any activities inside the lab and provides place during the working of bachelor thesis.
8. Without the support of PT. F1 Perkasa and Department of Marine and Fisheries of Cilacap providing informations, data, learning opportunity, this research would get a good progress.
9. To all my friends BARAKUDA '13. Especially my unforgettable classmates DD Marine Engineering '13 (Lusi, Dhimas Ndon, Fitri, Gishel, Anthony, Yayak, Danu, Dedelucu, Damas, Aldio, Juntak, Tri, Alfa, Suryo, Dante, Adi Frimpong, Jericho, Ario, Thariq, Mizan, Nyimas, Leo, Ilham, Dicky, Eka, Eqi, Bikso, Bramasto, Dani

Bandung, Juda, Nauval, Faisal, Rifqi, Arfan, Hikari, Rhandy, Adhit WP, Ago, Dioco Carlos). Thank you for experience and teamwork during our study at Marine Engineering Department. This is the beginning step for our journey. The author hope that our generation could give influence of positive things for Indonesia advancement.

10. To all members and my friends in RAMS Laboratory. Your kindness and gratefull assistance will always remembered.
11. To my senior high school mates "GAZENG HALAL" and "Grup Faedah" has many accompanying discussion and joking via group chat although we've rarely meet. I would wish the best for us. Be the good people to the other and keep doing *halal* things.
12. And to all parties I can't mentioned here. I would like to say thank you for the support and motivation.
13. To Real Madrid Football Club which has accompanying and entertain author in every night of football match.

The author realizes that there are still some mistakes and deficiency in doing this bachelor thesis. Hopefully the future of the various suggestions and criticisms can improved of other reports. The author hoping this thesis can be useful for reader and the writer himself for further study materials. *Amin ya robbal 'alamin*.

Surabaya, July 2017

TABLE OF CONTENTS

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LIST OF TABLES

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LIST OF FIGURES

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CHAPTER 1
INTRODUCTION

1.1 Background

Fishery is a unit determined by an authority or other entity that is engaged in raising and/or harvesting fish. Typically, the unit is defined in terms of some or all of the following: people involved, species or type of fish, area of water or seabed, method of fishing, class of boats and purpose of the activities. (FAO : Fishery Glossary)

Cilacap district has a great sea fishery potential to be deleveloped. With the fishing ground area reaching for about 5200 km^2, marine waters in Cilacap District has wealth of resources of fish types with fish hauling potential reach to 865100 ton, among others are Pelagic Fish, Small Pelagic Fish, Demersal Fish, Shrimp, Squid. Based on the data from Department of Marine and Fisheries of Cilacap District there are 3936 units of fishing vessel fleet in Cilacap District which consists of boat without engine 182 units, outboard engine 3226 units, motor vessel 528 unit, longline fishing vessel 118 units. (Department of Marine and Fisheries of Cilacap District, 2015).

Unfortunately, the fishery potential in sea territorial of Cilacap has not to be maximized yet. Because, the majority of fishing vessels to be operated are below 30 gross tonnage (GT) so that, it can't reach the exclusive economic zone (EEZ). From the quantity of 3936 fishing vessel fleets which belongs to fisherman, there are approximate less than 10% of fishing vessels with size above 30 GT. Most of them, solely small vessels which unable to reach exclusive economic zone (EEZ). The lack of proper fishing vessel fleets cause the fish catching not optimal yet. Consider to those condition, there are investment opportunities for long line fleet business and establishment of ship docking 100 GT. (Cilacap District Government, 2015)

The utilization of fiberglass material to building vessels in fishery activity was developed since the beginning of 1960s. Producer countries such as the USA and Japan were trying to market this type of material to other countries, including Indonesia in 1970s as replacement alternative of wood and steel (Pasaribu, 1985). Alternative manufacture of fiberglass vessel as production and transportation facilities has an important role in fishery, because the raw materials are easy to get and the maintenance is quite easy.

Fishing vessel has a huge potential. To increase investment interest in the world of local fishing vessels, research must be carried out about the investments of fishing vessels especially long line fishing vessel which utilize fiberglass to find out the investment feasibility for this type of fishing vessel viewed from the size of vessel and profit which can be obtained, so that could giving the figure of economic value started from initial investment, ship building cost, ship operational cost, ship profit average per year, and payback period. Hopefully, could maximize the management of sea products in Cilacap District in this particular capture fisheries.

1.2 Statement of Problems

Based on the background which has explained in previous section, followings are the statement of problems :

1. How to determine fisheries productivity of long liner fishing vessel ?
2. How to determine the ship building cost and ship operational cost for long liner fishing vessel with fiberglass construction in Cilacap District ?
3. How to estimate the revenue which can be obtained after investing ?
4. How to determine the feasibility of investment outcome for long liner fishing vessel with fiberglass construction in Cilacap District ?

1.3 Research Limitations

The limitations of this thesis are :

1. This thesis is focusing on investment feasibility of long liner fishing vessel with fiberglass construction by considering the ship building cost and ship operational cost
2. Design process and technical calculation for long liner fishing vessel with fiberglass construction is not included
3. Observation solely carried out to one type of sample vessel
4. The data of sea fisheries capture production solely done in marine waters surrounding Cilacap which still in exclusive economic zone (EEZ) of Indonesia

1.4 Research Objectives

The objectives of this thesis are :

1. Determine the ship building cost for long liner fishing vessel with FRP construction in Cilacap based on sample ship >30 GT

2. Ship operational cost for long liner fishing vessel with fiberglass construction in Cilacap District
3. To know the production of fish capturing using long line method in Cilacap District
4. Estimate the income which can be obtained after investing
5. Determine the feasibility of investment outcome for long liner fishing vessel with fiberglass construction in Cilacap District

1.5 Research Benefits

The benefits could be obtained from this thesis are :

1. Knowing the investment illustration of long liner fishing vessel with fiberglass construction in Cilacap District
2. Give information to ship owner about ship building cost for fishing vessel with fiberglass
3. To be use as consideration for shipyard industrialist which will build fishing vessel with fiberglass

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CHAPTER 2
LITERATURE REVIEW

2.1 Overview

2.1.1 Potential of Sea Fisheries in Cilacap District

Marine waters in Cilacap District which surrounding territorial zone and exclusive economic zone (EEZ) of Indonesia has great potential with sea fishery capture product potential reach to approximately 865100 ton which divided by the following fish species :

- Big Pelagic Fish with 275600 ton potential
- Small Pelagic Fish with 428700 ton potential
- Demersal Fish with 134100 ton potential
- Shrimp with 12500 ton potential
- Squid with 3200 ton potential

Fishing ground of long liner fishing vessel from Cilacap and Benoa located in south sea of Central Java between 108 – 118^0 E and 8 – 22^0 S (Wudianto, 2003). Commonly, some of sea fishery capture systems in Cilacap still unable to reach the EEZ zone, so that the facilities support are required to reach the fishing ground area in EEZ zone. Therefore, sea fishery potential in Cilacap District still need to be optimized more to obtain the maximal production. (Cilacap District Government, 2015)

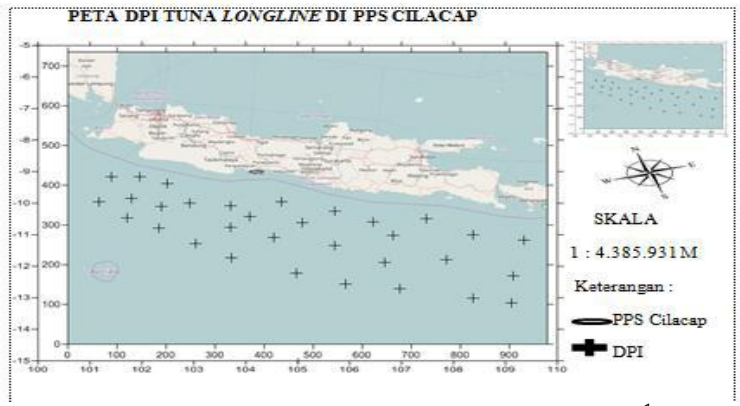

Figure 2.1. Fishing ground of long liner in Cilacap District[1]

[1] Puskodal Ditjen PSDKP, KKP, 2015

2.1.2 Sea Fisheries Production in Cilacap District

Table 2.1. Sea fisheries capture production in Cilacap District 2011 - 2015[2]

Species	2011	2012	2013	2014	2015
	Ton	Ton	Ton	Ton	Ton
Big Pelagic Fish (Tuna, cakalang, layaran, hiu, pari, dll)	5215	6739	5824	2946	5243
Small Pelagic Fish (Kembung, laying, selar, teri tongkol lisong, dll)	369	1516	1214	1295	1281
Big Demersal Fish (Kakap, balong, cunang, pelus pari, hiu botol, kerapu, manyung, dll)	477	849	526	1002	930
Small Demersal Fish (Gulmah, kurisi, kerot-kerot, beloso, petek, dll)	3490	5266	3633	1840	2299
Mollusca	2611	1201	370	4343	2806
Crustaceae	4357	5943	3410	2344	1827
Total	16518	21515	14977	13772	14386

Based on the Table 2.1., sea fisheries capture production in Cilacap District were experiencing rise and slope every year since 2011 to 2015. As it can be seen from the species types of fish, the big pelagic fish always dominating sea fisheries capture production in Cilacap District. In 2012, fish production quantity rose from the previous year with quantity was 6739 ton, but in 2013 declined to 5824 ton. During 2014, the fish production quantity drastically fell to 2946 ton. Big rose was occur in 2015 with production quantity became 5243 ton.

2.1.3 Fish Capturing Unit in Cilacap District

Fish capturing unit is a unit which can't be separated from a successful of fish capturing operation include fishing vessel and fishing gear.

1) Fishing Vessels

Fishing vessels which utilizing Pelabuhan Perikanan Samudera (PPS) Cilacap including fishing vessel with wood, fiberglass, and steel material.

[2] Statistical Data of Fisheries Capture in Cilacap, 2015

Mostly, fish capturing fleets are motor vessel. Ship with size of 0-20 GT classified as outboard engine vessel (traditional) and size of 20 – 200 GT classified as motor vessel. This ship has classified to modern ship because the engine is attained inside engine room and has a well-used navigation equipment. This ship has divided into many types based on the size, there are 5-10 GT, 10-20 GT, 20-30 GT, > 30 GT. Data of fishing vessel fleet quantity in Cilacap during 2015 is presented on Table 2.2.

In Table 2.2. obviously shows the quantity of fishing vessel fleet in Cilacap during 2015. The total quantity of fishing vessel fleet was 3936 units. Based on the table, ouboard engine vessel was the most widely quantity with 3226 units and the quantity for motor vessel was 528 units which mean the second widely after outboard engine. Boat without engine was the fewest quantity with 182 units. As it can be seen, tuna long line fleet was solely 118 units which consists of 38 units for ship size 20-30 GT and 80 units for ship size > 30 GT.

Based on big pelagic fish potential in Cilacap, the quantity of tuna long line fleet need to be added more to reach the maximal production. Tuna long liner fishing vessel specification in Cilacap is presented in Table 2.3.

Table 2.3. Tuna long liner fishing vessel specification in Cilacap[3]

No	Specification	Information
1.	Ship Dimension - Length - Breadth - Height - Draft	 21,02 – 26,42 m 5,10 – 7,24 m 1,30 – 3,27 m 0,90 – 2,90 m
2.	Tonnage	33 – 137 GT
3.	Construction Material	Wood, Fiberglass
4.	Year Built	1994 – 2004
5.	Main Engine	250 – 400 HP
6.	Hatch Capacity	8 – 40 ton

2) Fishing Gear

Based on the Table 2.4. there are many fishing gears which has operated by fishing vessel in Cilacap including seine net, gill net, line, traps, collection gear, and others fishing gear.

As it can be seen. the total of fishing gear quantity during 2015 was 10033 units. Gill net was the most widely fishing gear used with quantity reach to 5411 units. And the second widely fishing gear used was trap with 1936 units.

[3] Condition of Fisheries Capture in South Java Sea, IPB, 2008

Table 2.2. Quantity of fishing vessel fleet in Cilacap[4]

Fishing Vessel Fleet (2015)															
Types of Fishing Gear		Total Quantity	Without Boat	Boat Without Motor				Outboard Engine				Motor Vessel			
				Sub Total	Jukung	Board Boat		Sub Total	< 5 GT	5 – 10 GT	10 – 20 GT	Sub Total	10 – 20 GT	20 – 30 GT	> 30 GT
						Small	Medium								
Quantity of Fleet (Units)		3936	-	182	-	182	-	3226	2534	614	78	528	235	213	80
Seine Net	Payang	138		-		-		138	-	138	-	-	-	-	-
	Danish seine	389		-		-		389	189	-	-	-	-	-	-
Gill Net	Monofilament drift gill net	478		-		-		385	269	116	-	92	92	-	-
	Nylon drift gill net	175		-		-		-	-	-	-	175	-	175	-
	Shrimp gill net	342		-		-		342	342	-	-	-	-	-	-
	Set gill net	894		92		92		686	467	179	41	115	115	-	-
	Trammel net	363		-		-		335	335	-	-	27	27	-	-
Line	Tuna long line	118		-		-		-	-	-	-	118	-	38	80
	Drift long line	78		-		-		78	-	78	-	-	-	-	-
	Set bottom long line	140		-		-		140	-	103	37	-	-	-	-
Traps	Stow net	444		-		-		444	444	-	-	-	-	-	-
	Portable trap	304		90		90		214	214	-	-	-	-	-	-
	Other traps	-		-		-		-	-	-	-	-	-	-	-
Collection Gear	Snail collection	-		-		-		-	-	-	-	-	-	-	-
	Shellfish collection	74		-		-		74	74	-	-	-	-	-	-
Others	Cash net	-		-		-		-	-	-	-	-	-	-	-
	Harpoon and others	-		-		-		-	-	-	-	-	-	-	-

[4] Statistical Data of Fisheries Capture in Cilacap, 2015

Table 2.4. Quantity of fishing gear in Cilacap[5]

Fishing Gear (2015)															
Types of Fishing Gear		Total Quantity	Without Boat	Boat Without Motor				Outboard Engine				Motor Vessel			
				Sub Total	Jukung	Board Boat		Sub Total	< 5 GT	5 – 10 GT	10 – 20 GT	Sub Total	10 – 20 GT	20 – 30 GT	> 30 GT
						Small	Small								
Quantity of Fishing Gear (Units)		10033	1015	224	-	224	-	8183	6987	1116	80	611	318	213	80
Seine Net	Payang	251	-	-		-		251	-	251	-	-	-	-	-
	Danish seine	1073	-	-		-		1073	1073	-	-	-	-	-	-
Gill Net	Monofilament drift gill net	1078	-	-		-		953	742	211	-	125	125	-	-
	Nylon drift gill net	175	-	-		-		-	-	-	-	175	-	175	-
	Shrimp gill net	942	-	-		-		942	942	-	-	-	-	-	-
	Set gill net	1912	-	102		102		1654	1287	325	42	156	156	-	-
	Trammel net	1304	340	-		-		925	925	-	-	37	37	-	-
Line	Tuna long line	118	-	-		-		-	-	-	-	118	-	38	80
	Drift long line	142	-	-		-		142	-	142	-	-	-	-	-
	Set bottom long line	225	-	-		-		225	-	187	38	-	-	-	-
Traps	Stow net	1224	-	-		-		1224	1224	-	-	-	-	-	-
	Portable trap	712	-	122		122		590	590	-	-	-	-	-	-
	Other traps	-	-	-		-		-	-	-	-	-	-	-	-
Collection Gear	Snail collection	-	-	-		-		-	-	-	-	-	-	-	-
	Shellfish collection	567	363	-		-		204	204	-	-	-	-	-	-
Others	Cash net	312	312	-		-		-	-	-	-	-	-	-	-
	Harpoon and others	-	-	-		-		-	-	-	-	-	-	-	-

[5] Statistical Data of Fisheries Capture in Cilacap, 2015

2.2 Fishing Vessel Definition

According to (Nomura & Yamazaki, 1977) fishing vessels are classified into four types following :

- Fishing vessel typically used in fishing operations or to collect biological resources underwater, among others shrimp trawlers, boats purse seine, boat gill nets, boat seine, boat trolling, longline vessels, huhate ships, and canoes were used to collect the seaweed, fishing and others.
- Mother ship is a ship that is used as a place to collect fish caught by fishing vessels and process it. The mother ship also serves as a fish transport vessel. This is related to considerations of efficiency and financial capital.
- Fish transport vessel is a vessel used to transport fishery products from the mother ship or fishing vessels from the fishing ground to the port which is categorized as freighter.
- Research, education and training vessel is a fishing vessel which used for research, education and fishing training , mostly owned by ships agency or government.

According to (Fyson, 1985), Fishing vessels generally consist of the following : fishing vessel, fish transport vessel, survey vessel, training vessel and fishery patrol ship.

- Fishing vessel is a vessel which constructed and used specifically to capture fish in accordance with the fishing gear and fishing techniques used include collecting, storing and preserving.
- Fish transport vessel is a specially constructed vessel, equipped with special hatch used for collecting, storing, preserving and transporting fish captures.
- Survey vessel is a specially constructed vessel for conducting surveys of marine fisheries.
- Training vessel is a specially constructed vessel for the fishing training.
- Fishery patrol ship is a specially constructed ship for monitoring activities of fishing vessels.

2.3 Fishing Vessel Classification

Table 2.5. shows classification of fishing vessel which divided by the types of fishing gear used. There are trawl, seine net, purse seine, gill net, lift net, line, trap, shellfish and seaweed collection gear, muro ami, and others fishing gear.

Table 2.5. Fishing vessel classification based on the types of fishing gear[6]

No	Classification	Type
1.	Trawl	1. Shrimp trawl 2. Fish net 3. Other trawl
2.	Seine net	1. Payang 2. Danish seine 3. Beach seine
3.	Purse seine	1. Purse seine
4.	Gill net	1. Drift gillnet 2. Encircling gillnet 3. Shrimp gillnet 4. Set gillnet 5. Trammel net
5.	Lift net	1. Boat part 2. Craft part 3. Embed part 4. Bouke ami
6.	Line	1. Tuna long line / drift long line 2. Set bottom long line 3. Pole and line 4. Troll line 5. Hand line 6. Squid jigging
7.	Trap	1. Guiding barrier 2. Stow net 3. Portable trap 4. Long bag set net 5. Others trap
8.	Shellfish and seaweed collection gear	1. Shellfish collection gear 2. Seawedd collection gear
9.	Muro ami	1. Muro ami
10.	Others fishing gear	1. Cash net 2. Harpoon 3. Push net

[6] Imam, Sukanto, & Fajar "UNDIP Naval Architect Journal", 2012

2.4 Ship with FRP Construction

2.4.1 Fiberglass Reinforcement Plastic (FRP)

Fibreglass reinforcement plastic (FRP), or more commonly known as fiberglass is a combination of the two components that have different physical characteristics, but both have complementary characteristic (Fyson, 1985). Fiberglass material could be as consideration for people who want to build a ship. Some things into consideration of choosing fiberglass material among others are fiberglass material easily available in any chemistry stores, moreover fiberglass material is more durable and stronger than the wood which getting rotten easily, and also the maintenance of fiberglass ship is easier than wooden ship (Yulianto, 2010).

Fiberglass on lately received attention among shipbuilding experts as material to build a ship, indicating that the vessel which made of fiberglass materials increased in the making. The use of fiberglass raw material widely used in shipbuilding such as speed boats, patrol boats, fishing boats, and cruises (Sari, 2009).

Various fiberglass available in various compositions and specifications, making it suitable for use in a variety of processes and the desired strength. Types of fiberglass which are the most commonly used in the lining of the hull are (Djaya, 2008):

1) Chopped Strand Mat

Chopped Strand Mat, in use in the industry is often called Mat or the Matto, in the form of pieces of fiberglass fibers with a length of about 50 mm were arranged randomly and formed into a sheet. This type is reinforcing fiber with random fiber configuration and not constantly reinforcing fiber. The reinforcing fiber used is E-glass.

2) Woven roving

Woven roving is continuously reinforcement fibers woven shaped with the direction perpendicular to each other. In the lamination process the weight ratio between the fiber woven roving with resin are woven rovings 45-50% and polyester resin 50-55% from the heavy fraction, for building a ship generally used composition of woven rovings 50% and resin 50% , woven rovings are used as main lamination which provides tensile or curved strength higher than matto lamination.

3) Woven cloth

Similar with woven rovings, several rolls of fiber spun and then woven into one which looks like a fabric. Cloth add thickness slowly, more economical when used separately. Cloth used to repair damage to the coating.

4) Triaxial

Triaxial is a continuous reinforcement fiber (Continuous fibre reinforced) with reinforcing fiber configuration consists of three layers, there are the first layer 45 ° to the principal axis and the direction of the second layer 0º to the principal axis and the direction of the third layer - 45 ° to the principal axis. The weight ratio between the fiber triaxial with the resin used are triaxial fiber 45-50% and polyester resin 50-65% of the heavy fraction, but for building a ship generally used 50%: 50% in one lamination.

FRP woven roving is stronger when compared with aluminum, FRP mat and steel are stiffer than mat and steel although the most rigid is aluminum. With the same weight, wood (in wet condition) is stiffer than FRP cloth and also stronger than FRP mat, but FRP woven roving is stronger than wood.

Glass fibers normally used in the manufacture of fiberglass ship are Matt 300 and 450 and Woven Roving 600. Resins which used to make the ship is 3,115 SHCP Unsaturated polyester resin. Moreover, these components can be combined with pigments, flame retardants and certain toxic materials to prevent vermin on ship surfaces (Imron, 2004).

2.4.2 Lamination Methods of FRP

In building a ship with fiberglass construction there are 3 methods of lamination which often used on shipyard. The following are explantion about lamination methods :

1) Hand Lay-Up Method

Hand lay-up method is the most convenient and the simplest method. Lamination process solely use a hand assisted with roll which serves to unify the fiberglass and resin so that the resin can absorb into layers of fiberglass to the maximum so that the curing process could

last well and the end result of the lamination process could be maximized.

Disadvantages of this method are not maximal result of unification of layers or arrangement between the fiberglass and resin on the ship were formed. This is because the use of a tool to unify the resin and fiberglass material solely using the roll so that the pressure generated is not maximized and not evenly distributed throughout the body section of the ship. So there is still the possibility of the presence of air-filled spaces which cause tensile strength values of the ship reduced.

The coating process of fiberglass material and resin will be forwarded to obtain the desired thickness and in accordance with the characteristics which want applied to the produced ship. The simple process and does not require expensive equipment makes the vessel formation process using this type is quite interesting for most of shipyard despite the hull production time by using this method is long enough.

The advantages of this method when applied, the results of hull layers are smooth generated, both the outer layer and the inner layer of the hull. Although there are some drawbacks to this method but the mechanical characteristic which generated is more than enough to be applied to the ship in general. Following are the procedures of this method :

a. Preparing for mold
b. Wax and polish the mold to make it easier to use mold again
c. Polish the gelcoat on the mold surface and allowed to harden before installing a layer
d. Barrier coat is also used to prevent the printed of fiber through gelcoat surface
e. Then fiberglass installed properly with the following the pattern of mold. Usually the types of fiberglass used are chopped strand mat and woven roving
f. The resin is mixed with the catalyst and stir until smooth and then accommodated in the holding tank
g. Resin which has mixed with catalyst is sprayed onto the mold surface by using a spray gun. Spray gun is moved with a predetermined pattern to make the same thickness
h. Then use a brush or roller to compact the fiber which is poured or sprayed with resin to produce a smooth surface and eliminates trapped air

i. Could use wood, foam, honeycomb core which will fitted into the lamination to make a sandwich structure
j. Lamination will dry itself

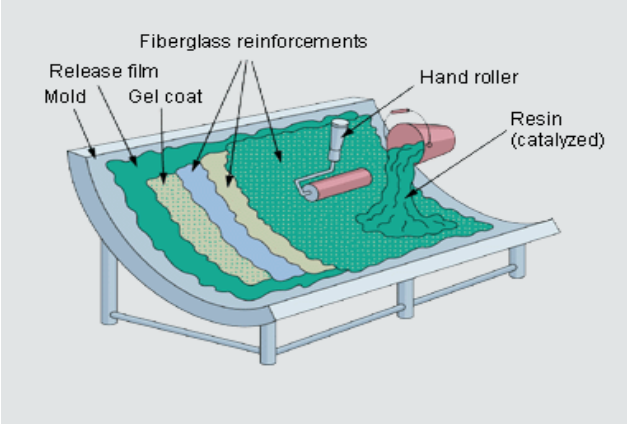

Figure 2.2. Hand lay-up process[7]

2) Chopped Gun Method

This method uses a kind of gun to shoot fiberglass in small pieces and mixed with resin short across the lining of the mold then assembled with the aid of a roll. Fiber pieces formed in small pieces known as chopped fibers so that the method is called chopped gun.

This method is quite a lot of weaknesses, with a layer of fiberglass is chopped in the small size and spread to all directions randomly, then the lamination result of this method has a low tensile strength. Another thing that constraint is the uneven thickness result due to the lack of control of layer thickness so that the result is less dense.

But this method could be considered if the shipyard requires a fast and low cost production process, because by using this method does not require much time and lower costs. The obtained lamination are also quite light.

3) Vacuum Infusion Method

Vacuum infusion method is still rarely used in local shipyards because the method is still relatively new. This method utilizing the pressure of a pump that generates a vacuum so that the blend of resin and fiberglass can be pressed evenly. The advantage of this method is the result of a thinner, equitable, and more powerful lamination. This

[7] Produksi Kapal Perikanan Berbahan Dasar Kayu dan Fiberglass, IPB, 2012

method is also done with the condition that is cleaner than the previous method. However, the drawback is the cost of more expensive than the previous method because the preparation of this method is quite expensive.

Vacuum infusion is one of the Resin Transfer Moulding (RTM) system. In the RTM system, resin is injected into a rigid mold. The prints result are goods or parts which has two smooth sides. Vacuum infusion system has the same principle with RTM system but solely the upper part of mold is replaced with a plastic film (plastic sheeting) and a resin distribution medium.

Several reinforcement layers (CSM, WR, or Multiaxial Fiberglass) are placed in a mold which has coated with gelcoat first. Above reinforcement layer material is placed nylon fabric (peel-ply) then the resin distribution medium will placed on the top, then the plastic film and resin feed hose are placed between the distribution medium and plastic. Vacuum port is placed surrounding the area of fiberglass which will given a resin.

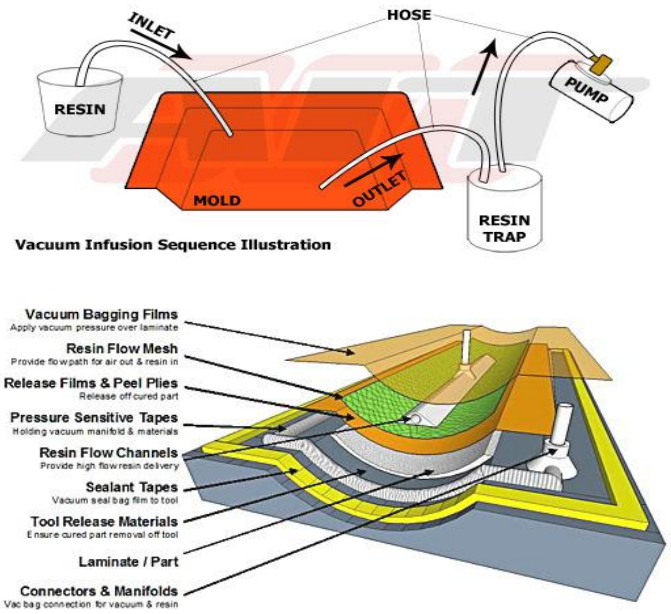

Figure 2.3. Vacuum infusion process[8]

[8] Produksi Kapal Perikanan Berbahan Dasar Kayu dan Fiberglass, IPB, 2012

2.4.3 Building Process of FRP Constructed Ship

FRP construction vessel building process is certainly very different from the process of ship construction made from other materials such as steel, aluminum, and wood. The production process of FRP vessel is lighter than steel vessel. That is because the ship building with FRP construction should begin with the preparation of the mold. In the production process of steel vessel there are several works such as welding, assembly, cutting, bending. While the FRP vessel solely made with the initial capital of a mold to form the vessel. The mold making process usually using FRP material which has a certain thickness and tensile strength, such as using CSM 600 or can be made with wood and plywood. Following the flowchart diagram of FRP shipbuilding process :

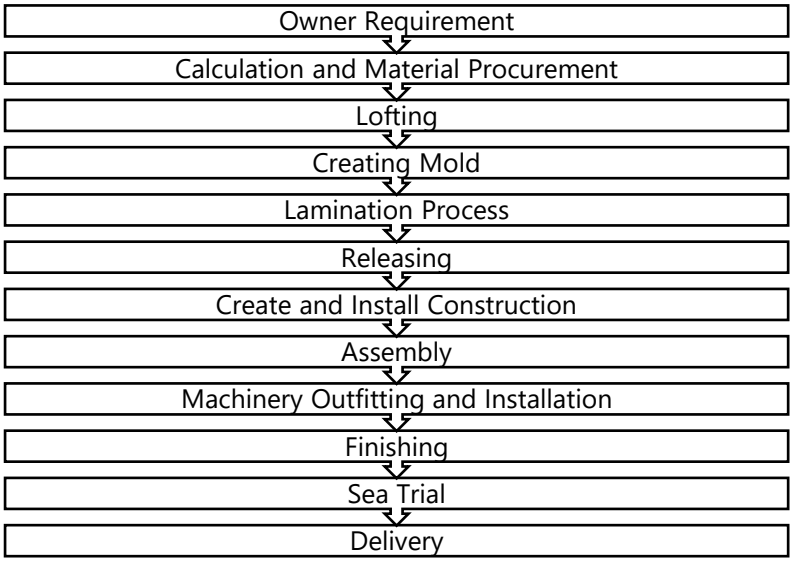

Figure 2.4. Flowchart diagram of shipbuilding process with FRP construction[9]

2.5 Fishing Vessel with Long Liner Fishing Gear

2.5.1. Long Liner Method

Long liner method is a passive fishing method which uses the floated main line. Line is floated by using buoys which the distance has been measured. On the main line there are branch lines where the hooks on the bottom attached.

[9] Coackley, Ned "Fishing Boat Construction : 2 Building a Fiberglass Fishing Boat", 1991

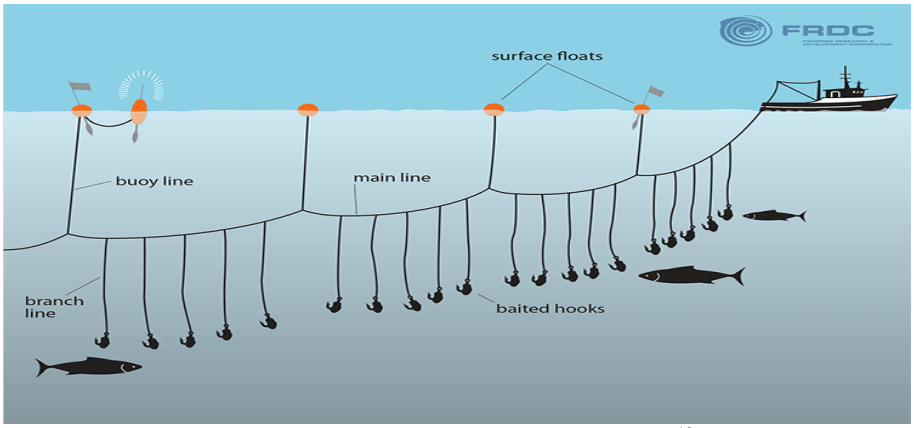

Figure 2.5. Long line fishing vessel[10]

The main line is made from monofilament with diameter of 3-4 mm. This line is circular cross section shaped and colorless (transparent), some lines are blue because blue is believed to not be easily seen by the fish. The main line has a length of 250 m to 800 m. Then the branch lines are also made from monofilament size of 2 mm. This lines has a length of 10 to 50 m down and fitted with a space of 60 to 100 m on the main line.

The most important thing in using long liner method is this method needs to be adjusted to the proper depth because tuna fishes are swimming in a certain depth. To be able to adjust the depth of the main line should be done by setting the interval of the main line between the buoys.

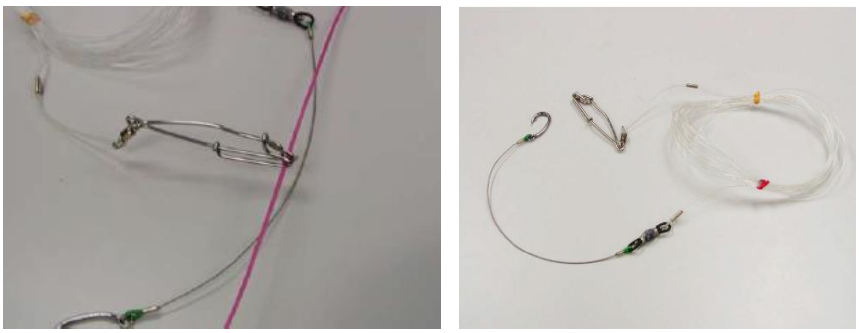

Figure 2.6. Main line and Branch line[11]

The branch lines are mounted on the main line using snap, ring, and sleeves. These lines connection should be mounted without bond because

[10] http://www.smithinst.co.uk/case-study/algorithms-for-detecting-illegal-fishing/
[11] http://www.longlinefishing.biz/en/

the bond will reduce the strength of the main line. Then at the bottom of the branch lines hung hooks to capture fish.

2.5.2. Work Principle of Long Liner Fishing Vessel

Long liner method is the first fishing method which used in Japan. This method is now widely applied because of its advantages to capture tuna fish at a depth of 300 m above sea level. One set of lines can be composed of more than 200 units of "basket". Basket every section of main line and its branch lines between two buoys with total of approximately 3,000 hooks. Following the work principle of long liner fishing vessel in general :

1. Baiting Long Line
   The first step taken is to pairing the bait to the hook. This process could be done using a machine or manually. Usually squid, mackerel, or other small fish used as decoys. If done manually, a crew is responsible for pairing the bait to the hook. After that, another crew will install the decoys after it has tied to a branch line of the main line.

2. Setting Long Lines
   This process is carried out simultaneously with the process of installing the bait to the hook. The main line is rolled up and then will be stretched through a machine located at the stern of the ship and then simultaneously when stretched, branch lines already baited will installed on the main line. The vessel will be run at a speed of 9.5 - 11.5 knots. Setting the depth of the main line can be adjusted by varying the distance between the buoys and by changing the speed of the main line feeder and vessel speed. The current pace of branch lines and buoys when installed on the main line and the space between the branch lines are arranged from the wheelhouse. On the buoys, there is a radio buoy that serves as a marker of the main line. Between 2500 and 3000 hooks deployed by the total length of the main line can reach 100 km. The time required for this process can last for 5 to 6 hours. After the radio buoy finally installed, the crews are rested for about 4 hours before the hauling process begins.

3. Hauling Long Lines
   The hauling process begins by looking for radio buoy. Once found, then the buoy is released and then the main line will start rolled using

the hauler machine. Rolling speed is determined by the crew who served because each matted strands should be straightened out again. Then, a crew will release the hook of branch lines while the main line is pulled back to the ship.

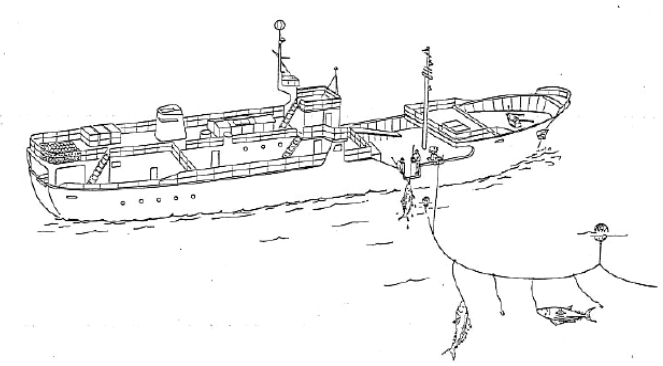

Figure 2.7. Hauling long lines[12]

4. Landing Catch
   When the fish is detected, the ship will slow down and then will follow the movement of the fish. When the fish is beside the vessel, a spear or a harpoon will be used to capture the fish. Once inside the ship, branch lines will be cut by allowing the hook is in the fish's mouth. This way is to arrange the fish easily and could directly put in the freezer.

5. Fish Handling On Board
   Fish which has reached the deck should be killed soon, because its dangerous when handling the fish which constantly moving on the deck of the ship as well as to keep the quality of the fish flesh remains in good condition. For tuna fish, the caudal fin must be removed immediately using a chainsaw. Then the fish will be put into cold storage after the gills and the entire contents of his stomach removed.

2.6 Feasibility Study

Feasibility study is a series of study which will help to make decision about a project. It is an analysis of the viability of an idea (Hofstrand & Holz-Clause, 2009). The feasibility study will study in-depth about specific business scenario and then may make a conclusion about the specific

[12] http://tuna.greenpeace.org/en/stories/the-process-of-long-lining-for-tuna/

scenario in the business. It will help the project leader decided wether the project must be continue or not using the information from it (Hofstrand & Holz-Clause, 2009).

There are benefits by applying feasibility before initiate a project. The benefits are:

1. Give a direction to the project and narrow alternatives which may exist.
2. Provide new chances and may identified the reason to not to proceed the project, if any.
3. It may suspect any factors which may affect the project and make a mitigations about it, therefore the project probability of success will increase.
4. Securing funding and may attract equity investment.
5. If properly conducted, may save money before the project are start.

The stages to conduct feasibility study in general are:

1. Preparation Stage
   On this stage, a careful planning of the whole project are done. Based on the purpose of the project it is decided wether its need to conduct a feasibility study on a propose business idea or not.
2. Research Stage
   The data for the project are taken on this stage.
3. Data Arranging Stage
   After all the data needed to conduct feasibility study, the data are categorized unto two section, primary data and secondary data. The data which already gather then tabulated and arrange according to the purpose of the project.
4. Data Processing Stage
   After carefuly arranged, the data are process and analyze then compile into a feasibility report. One of the indicator which indicate the research and the feasibility study will success is the quality of the feasibility study report.
5. Project Evaluation Stage
   The data which already process then compared to the requirement which indicate wether the project are feasible or not. The evaluation is in the form of technical calculation which compare the analyze data and the requirements.

2.7 Fish Catching Productivity Analysis

Productivity in this study is defined as the productivity of fisheries capture. Productivity is the ability to produce something. Productivity of fishing vessels according to the Ministerial Decree of Marine and Fisheries No. 38 year 2003 is the level of fishing vessel ability to obtain captures per year. Production per trip (Catch per Unit Effort) of long liner vessel based on the volume of fish caught and the number of trips Tuna Longliner (CPUE), with equation :

$$Catch\ per\ Unit\ Effort\ (CPUE) = \frac{Fish\ Capturing\ Volume\ (ton)}{Total\ Trip} \quad \text{.....(2.1)}$$

Productivity of long liner vessel is calculated in vessel size unit (Gross Tonnage), with equation :

$$Productivity = \frac{Production\ (ton)}{Trip\ x\ GT} \quad \text{.....(2.2)}$$

2.8 Economical Analysis

2.8.1 Ship Building Cost

Calculation of ship building costs was conducted to determine the cost needed in the building process of ship. The building cost of the vessel is the sum of the cost of the components needed to make a ship. Cost elements which are constituent part of the cost of building ship are as follows :

1) Casco cost
2) Equipment and installation cost such as electrical, safety, navigation, accommodation, machinery
3) Others service cost such as ship documentz, launching, sea trial, delivery

2.8.2 Ship Operational Cost

Operational costs are fixed costs which issued for daily operational aspects of ship with aim to make the ship always in good condition for commission. The components of operational costs are as follows :

- Provision Cost
  Provision cost is a cost for crew needs (food and beverages).
- Crew Cost
  Crew cost is a cost which issued for paying all crews salary during the operational of ship
- Maintenance and Repair Costs
  Maintenance and repair costs are including all requirements to maintain the ship always in good condition for sailing and be able to doing the fish capturing operation.
- Mooring and Anchoring Costs
  When the ship is docked in ports, the costs issued are including port dues and service charge. Port dues are fees charged for the use of port facilities such as docks, moorings, and infrastructure. Meanwhile, service charge includes the services of a porter or guide for landing mooring fishing vessel to the mainland shore.
- Depreciation
  Fixed assets (excluding land) and intangible property which owned by project is depreciated each year. The percentage of each type of fixed assets depreciation is determined by the government in each country where the project is built.
- Baiting Cost
  Baiting cost is a cost of all requirements to fulfill the baiting activity during the fish capturing operation

2.8.3 Voyage Cost

The voyage cost is the variable costs issued for the vessel needs during the voyage. Voyage cost are including : fuel cost for a main engine or for an auxiliary engine, fees of mooring or berths. Voyage cost components are :

- Fuel Cost
  Ship fuel consumption is determined by several variables such as the size of the vessel, shipping distance, speed, weather (waves, wind), the type and quality of fuel. Cost of fuel and lubricants are also dependent on the daily consumption of fuel for sailing at sea and on the port as well as the price of fuel during the voyage at sea and on the port.
- Fish Chiller Cost
  The ice consumption as fish chiller depends cargo quantity could be transported.

2.8.4 Financial Analysis

1) Payback Period (PP)

It is a required period to close the investment expenditure (initial cash investment) by using cash flow. The payback period can also be defined as the ratio between the initial cash investment with cash inflow which the result is a unit of time, then the value of this ratio compared with the maximum acceptable payback period (Umar, 2003). The formula is :

$$Payback\ Period = \frac{i}{\pi}\ x\ 1\ year \quad \text{.....(2.3)}$$

Where,

I = Investment

π = Profit per year

2) Net Present Value (NPV)

Net Present Value (NPV) is a method that is quite important in capital budgeting to measure the investment feasibility analysis of the project by calculating the Net Present Value. Net Present Value is the difference between the present value of the investment with the present value of net cash receipts in the future. Status of Net Present Value analysis method is quite strong in investment feasibility analysis of the project because Net Present Value already considering the time value of money. To calculate the present value need to be determined the interest rate which is relevant.

$$NPV = \sum_{t=1}^{n} \frac{Bt-Ct}{(1+i)^t} \quad \text{.....(2.4)}$$

Where,

Bt = Benefit which obtained in t-year

Ct = Cost issued in t-year

i = Discount rate

n = Investment period

If NPV > 0, the investment is profitable/eligible to continue
If NPV = 0, there are no profit and no loss in the investment
If NPV < 0, the investment is not eligible to continue

3) Internal Rate of Return (IRR)

Internal Rate of Return is the value of the discount rate (i) that makes the NPV of a project equal to zero. This analysis is used to determine the level of internal profits derived from the investment. Internal Rate of Return is expressed in the formula (Kadariah, 1999) :

$$\text{IRR} = i_1 + \left[\frac{NPV_1}{NPV_1 - NPV_2}\right] (i_2 - i_1) \text{.....(2.5)}$$

Where,
IRR = Internal Rate of Return
NPV_1 = NPV positive
NPV_2 = NPV negative
i_1 = Discount rate of positive NPV
i_2 = Discount rate of negative NPV

A business or investment activity is feasible, if the IRR is greater than the determined discount rate. Otherwise, if the IRR is less than the determined discount rate then business is not eligible to run.

4) Net Benefit Cost Ratio (Net B/C)

Net Benefit Cost Ratio is an indicator, used in the formal discipline of cost-benefit analysis, that attempts to summarize the overall value for money of a project or proposal. A benefit cost ratio is the ratio of the benefits of a project or proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms. All benefits and costs should be expressed in discounted present values. Benefit cost ratio (BCR) takes into account the amount of monetary gain realized by performing a project versus the amount it costs to execute the project. The higher the BCR the better the investment. General rule of thumb is that if the benefit is higher than the cost the project is a good investment. The formula is :

$$Net\ B/C\ R = \frac{\sum_{t=1}^{n} \frac{Bt-Ct}{(1+i)^t} > 0}{\sum_{t=1}^{n} \frac{Bt-Ct}{(1+i)^t} < 0} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.6)$$

Where,

Bt = Benefit which obtained in t-year
Ct = Cost issued in t-year
i = Discount rate
n = Investment period

Net B/C ratio value consists of two important things, there are :
1) Net B/C ratio ≥ 1 means the project is eligible
2) Net B/C ratio ≤ 1 means the project is not eligible

5) Break Even Point (BEP)

Break Even Point is a condition where production or income level is equal as the outcome of the project. Therefore, on that condition the project is not obtain any profit and loss. The formula is :

$$\text{BEP (Rp)} = \left[\frac{Fixed\ Cost}{1 - \frac{Total\ Variable\ Cost}{Sales\ Revenue}}\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.7)$$

$$\text{BEP (Units)} = \left[\frac{BEP\ (Rp)}{Selling\ Price\ Unit}\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.8)$$

If variable cost and fixed cost are not separated, then to find the break even point could use the principle of total income = total outcome
Total Income = Price x Production quantity
Total Outcome = Summary of all cost needed during project (Sales price unit x Production quantity)

$$\text{BEP (n)} = \left[\frac{BEP\ (Rp)}{Sales\ Revenue\ (Rp)}\right] x\ Total\ Production\ Quantity \ldots (2.9)$$

6) Discount Factor (DF)

Discount Factor is defined as : "Factors which used for calculating present value from the multiply of future income by considering applied interest rate or also called present worth factors". DF is counted for multi-period project. Commonly, the period is calculated by semester or year. Value of DF approximately from 0 to 1. The formula for calculating DF is :

$$DF\ per\ year = \frac{1}{(1+r)^n} \text{.....(2.10)}$$

Where,

r = Interest rate

n = year 0,1,..... n ; according to project period

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CHAPTER 3
METHODOLOGY

3.1 Methodology Flow Chart

Figure 3.1. shows a flowchart diagram of methodology which describe about the working process of this thesis from literature review, data collecting process, data processing, analysis of ship investment feasibility, also conclusion and recommendation.

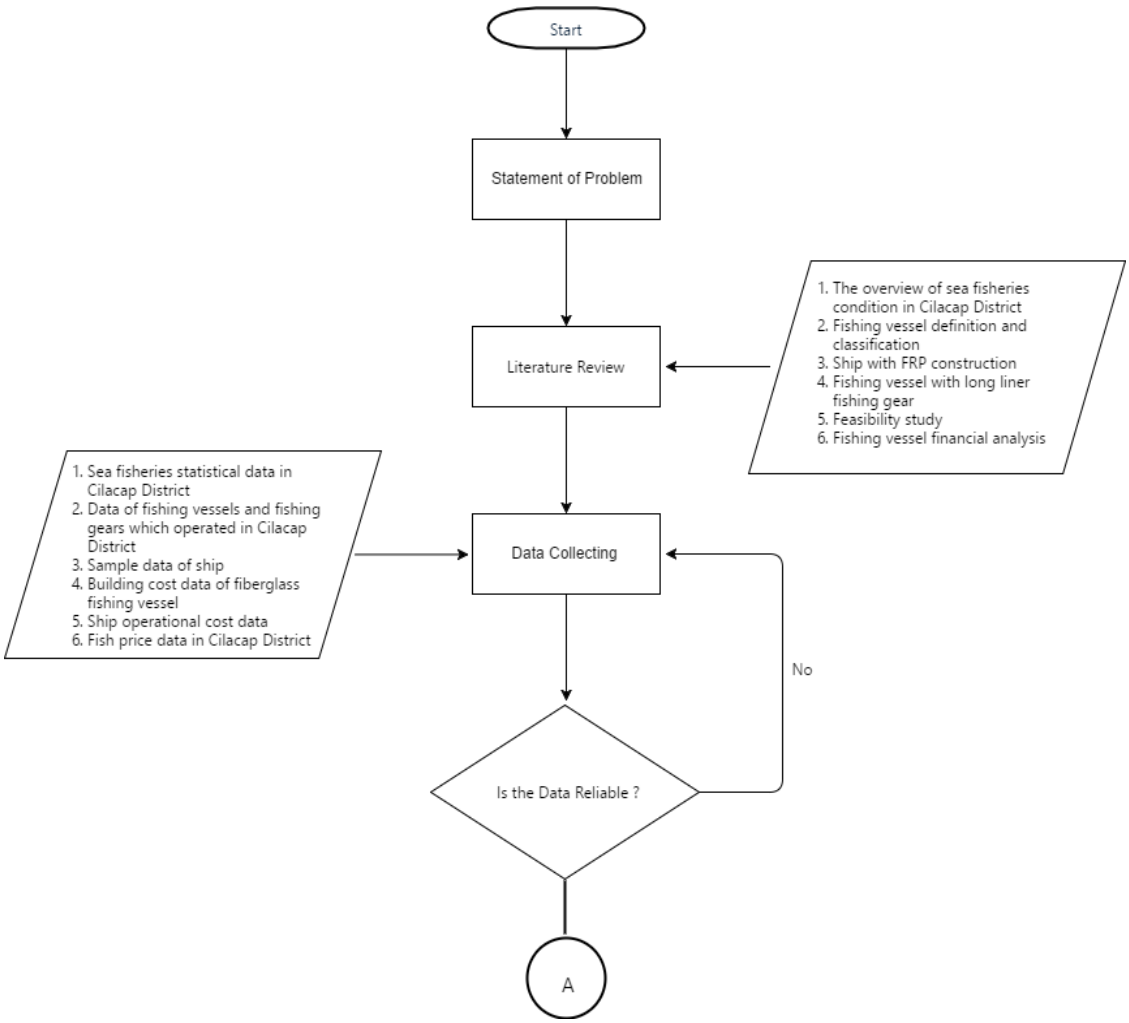


Figure 3.1. Flow chart diagram of methodology

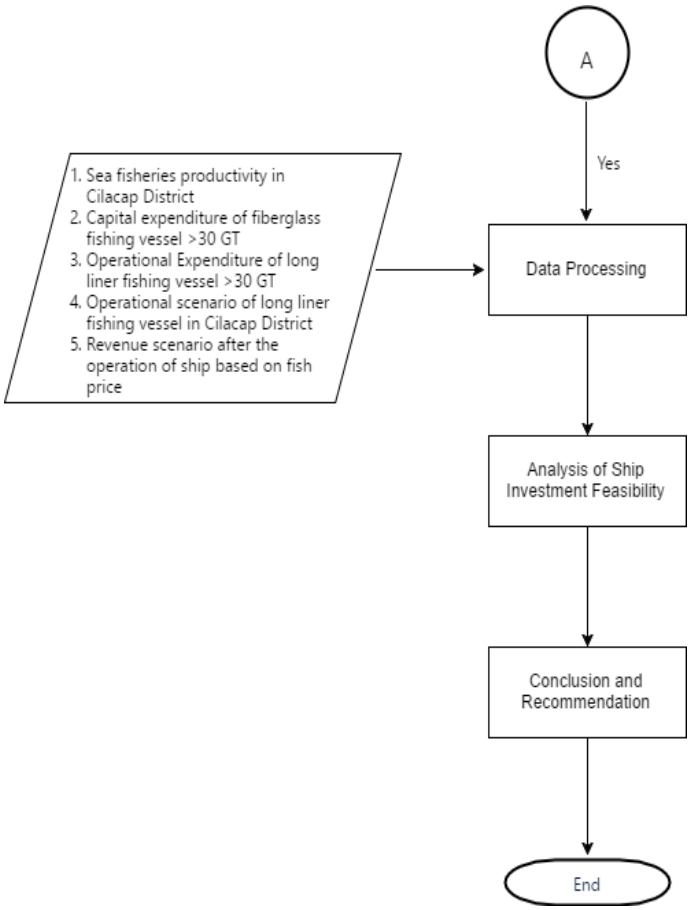


Figure 3.1. Flow chart diagram of methodology (continued)

3.2 Definition of Methodology Flow Chart

3.2.1 Statement of Problems

Identifying the problems is to determine what problem formulation to be taken. Formulation of the problem is an early stage in the implementation of the final project.

This stage is a very important stage, which at this stage why there is a problem that must be solved so worthy to be used as material in the final work.

Problem formulation is done by collect information about problems that occur at this time. From this stage, the purpose of why this thesis done is knowable. Statement of problems of this thesis were determined in chapter 1.

3.2.2 Literature Review

Once a problem is already known, the next step is to collect reference materials related to the final project from any resources.

The references of this thesis are received from books, journals, thesis report, and informations from internet which consists of the condition of sea fisheries in Cilacap District, fishing vessel definition and classification, ship with FRP construction, fishing vessel with long liner fishing gear, operational scenario of long liner fishing vessel in Cilacap District, feasibility study definition, fishing vessel financial analysis.

From the references which has been reviewed, then we know what data that we need to collect in this thesis.

3.2.3 Data Collecting

To support the thesis, we need to collect some data such as sea fisheries statistical data in Cilacap District, data of fishing vessels and fishing gears which operated in Cilacap District, sample data of ship, building cost data of fiberglass fishing vessel, ship operational cost data, fish price data in Cilacap District.

Some data such as sea fisheries statistical data, data of fishing vessels and fishing gears which operated, and fish price data are collected from Cilacap District Government and Department of Marine and Fisheries of Cilacap District. For sample data of ship and building cost data of fiberglass fishing vessel are collected from PT. F1 Perkasa in Banyuwangi.

From all those data which has been collected, the implementation of data processing shall be started.

Table 3.1. Data Requirements of this thesis

No	Data Collected	Sources
1	Sea fisheries statistical data	Department of Marine and Fisheries of Cilacap District
2	Data of operating fishing vessels	Cilacap Fishing Port (PPS Cilacap)
3	Data of operating fishing gears	Cilacap Fishing Port (PPS Cilacap)
4	Sample data of fishing vessel with FRP construction	PT. F1 Perkasa
5	Ship building cost data	PT. F1 Perkasa
6	Ship operational cost data	PT. F1 Perkasa and Cilacap Fishing Port (PPS Cilacap)
7	Fish price	Cilacap Fishing Port (PPS Cilacap)

3.2.4 Data Processing

The data which has been collected will processed and calculated using Microsoft Excel. From the data processing there will be some result could obtained such as sea fisheries productivity, capital expenditure of fiberglass fishing vessel >30 GT, operational expenditure of long liner fishing vessel >30 GT, operational scenario of long liner fishing vessel in Cilacap District, revenue scenario after the operation of ship based on fish price.

3.2.5 Analysis of Ship Investment Feasibility

After processing the data, should be carried out an assessment using Microsoft Excel whether the long liner fishing vessel investment in Cilacap is feasible or not by considering the financial factors such as : profit analysis, revenue cost ratio, payback period, net present value, net benefit cost ratio, and internal rate of return.

3.2.6 Conclusion and Recommendation

The final step is to make the conclusion that the whole process has been done before as well as provide answers to existing problems.

The recommendation given based on the results of the analysis on which to base the next research, either directly related to this research or on the data and methodology that will be referenced.

CHAPTER 4
DATA ANALYSIS

4.1 Tuna Long Liner Fisheries in Cilacap

4.1.1 Composition of Tuna Long Liner Catching Production

The composition of tuna long liner catching production are consist of target catch and by catch production . Target catch production of tuna long line are consist of yellowfin tuna (*Thunnus albacores)* 11% or 1.141,105 ton, big eye tuna (*Thunnus obesus)* 19% or 1.910,87 ton, albacore tuna (*Thunnus alalunga)* 14% or 1.409,30 ton, southern bluefin tuna (*Thunnus macoyii)* 0,40% or 40,91 ton. Another composition production is 56% or 5.767,78 ton. By catch production are consist of black marlin fish, white marlin fish, bawal stripes, mobula, meka, gindara, cakilan, and layaran. Catching production are landed in frozen shape and will be exported. Diagram of tuna long liner catching production is presented in Figure 4.1.

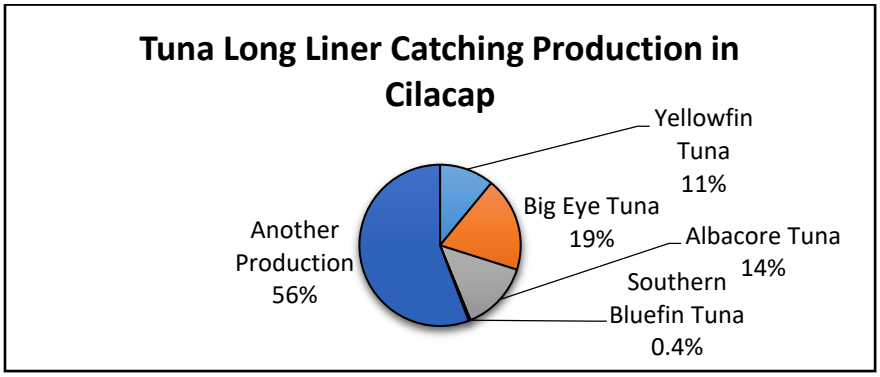


Figure 4.1. Tuna Long Liner Catching Production Diagram

4.1.2 Tuna Long Liner Productivity

1) Yellowfin Tuna Productivity

Annual productivity of tuna long line and total effort were fluctuative. In 2010 with catch effort 135 per unit, the productivity level was 10,18 ton of yellowfin tuna. In 2011 with catch effort 166 per unit, the productivity level was 42,81 ton of yellowfin tuna. In 2012 with catch effort 110 per unit, the productivity level was 16,82 ton of yellowfin tuna. In 2013 with catch effort 44 per unit, the productivity level was

21,04 ton of yellowfin tuna. In 2014 with catch effort 29,3 per unit, the poductivity level was 48,78 ton of yellowfin tuna. Graphic of yellowfin tuna productivity is presented in Figure 4.2.

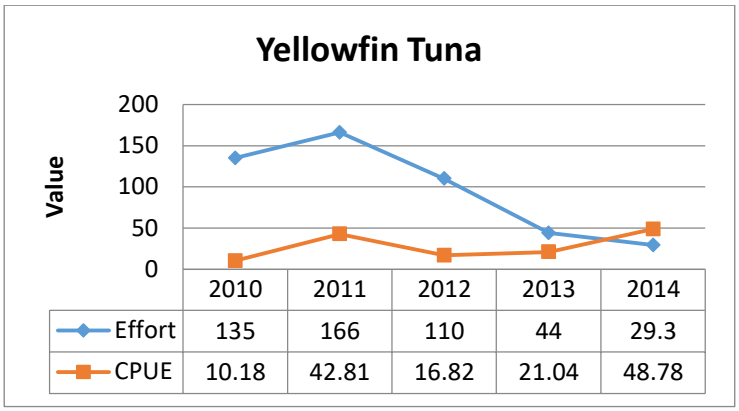


Figure 4.2. Graphic of yellowfin tuna productivity and effort

2) Big Eye Tuna Productivity

Annual productivity of tuna long line and total effort were fluctuative. In 2010 with catch effort 224 per unit, the productivity level was 278 ton of big eye tuna. In 2011 with catch effort 278 per unit, the productivity level was 17,3 ton of big eye tuna. In 2012 with catch effort 185 per unit, the productivity level was 21,7 ton of big eye tuna. In 2013 with catch effort 74 per unit, the productivity level was 28,6 ton of big eye tuna. In 2014 with catch effort 20,3 per unit, the productivity level was 35,8 ton of big eye tuna. Graphic of big eye tuna productivity is presented in Figure 4.3.

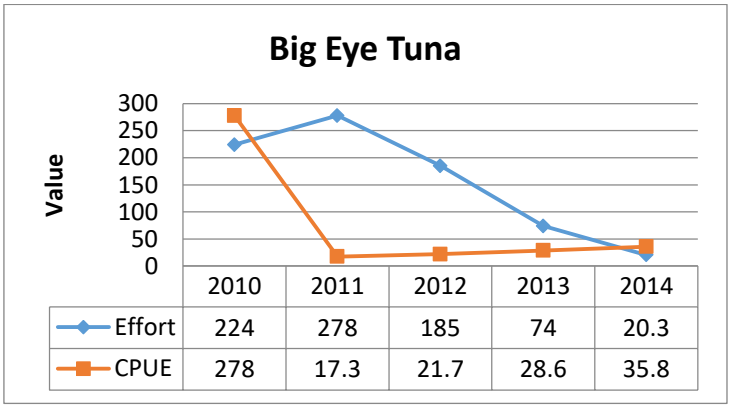
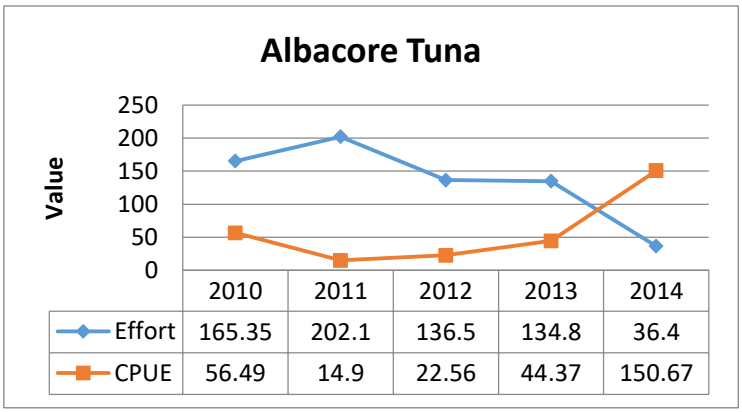


Figure 4.3. Graphic of big eye tuna productivity and effort

3) Albacore Tuna Productivity

Annual productivity of tuna long line and total effort were fluctuative. In 2010 with catch effort 165,35 per unit, the productivity level was 56,49 ton of albacore tuna. In 2011 with catch effort 202,1 per unit, the productivity level was 14,9 ton of albacore tuna. In 2012 with catch effort 136,5 per unit, the productivity level was 22,56 ton of albacore tuna. In 2013 with catch effort 134,8 per unit, the productivity level was 44,37 ton of albacore tuna. In 2014 with catch effort 36,4 per unit, the productivity level was 150,67 ton of albacore tuna. Graphic of albacore tuna productivity is presented in Figure 4.4.



	2010	2011	2012	2013	2014
Effort	165.35	202.1	136.5	134.8	36.4
CPUE	56.49	14.9	22.56	44.37	150.67

Figure 4.4. Graphic of albacore tuna productivity and effort

4) Southern Bluefin Tuna Productivity

Annual productivity of tuna long line and total effort were fluctuative. In 2010 with catch effort 2,72 per unit, the productivity level was 18,7 ton of southern bluefin tuna. In 2011 with catch effort 2,47 per unit, the productivity level was 16,53 ton of southern bluefin tuna. In 2012 with catch effort 2,8 per unit, the productivity level was 45,24 ton of southern bluefin tuna. In 2013 with catch effort 0,68 per unit, the productivity level was 28,75 ton of southern bluefin tuna. In 2014 with catch effort 0,02 per unit, the productivity level was 4,4 ton of southern bluefin tuna. Graphic of southern Bluefin tuna productivity is presented in Figure 4.4.

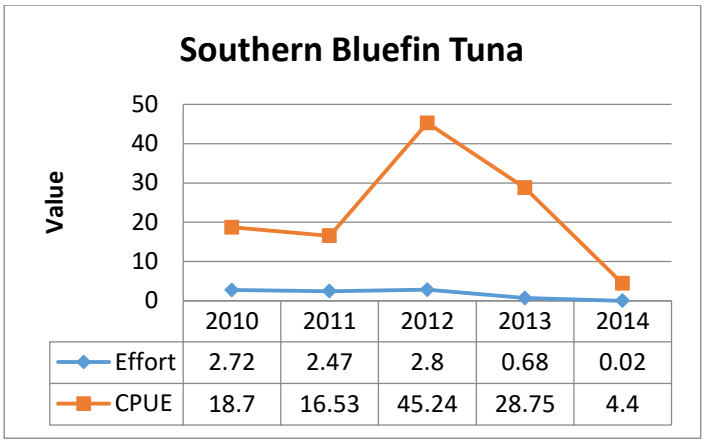


Figure 4.5. Graphic of southern bluefin tuna productivity and effort

5) Total Average of Tuna Productivity

During five years the average of tuna prdouctivity is shown that Big Eye Tuna had the highest average of productivity amount with catch effort 156,26 per unit and the productivity level was 14787,8 ton. The second highest was Albacore Tuna with catch effort 135,03 unit and the productivity level was 5379,04 ton. Then, there was Yellowfin Tuna with catch effort 96,86 unit and productivity level 2537,194. The lowest average of productivity was Southern Bluefin Tuna with catch effort 1,738 unit and the productivity level solely 47,59 ton. Graphic of average tuna productivity is presented in Figure 4.6.

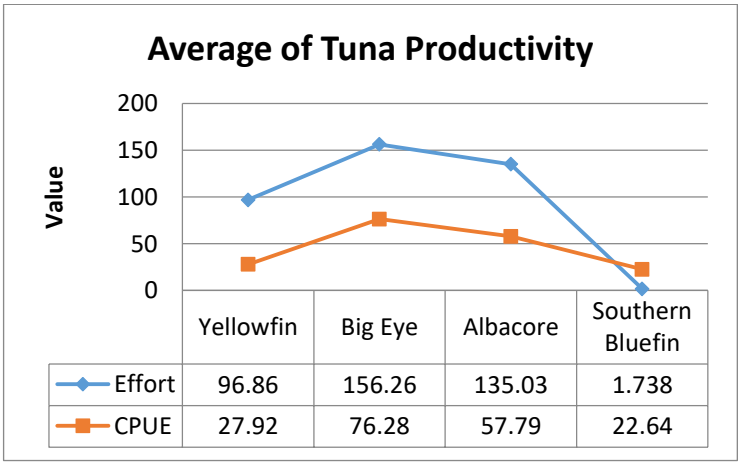


Figure 4.6. Graphic of average tuna productivity in Cilacap

4.2 Tuna Long Liner Fishing Vessel with FRP Construction

Figure 4.7. shows a sample fishing vessel with FRP construction named MV. Inka Mina 438 which constructed and used specifically to capture fish in accordance with the fishing gear and fishing techniques used include collecting, storing and preserving. For MV. Inka Mina 438 general arrangement (GA) is reflected on Figure 4.8. Both sample data of MV. Inka Mina 438 and the general arrangement are collected from PT. F1 Perkasa

Figure 4.7. MV. Inka Mina 438[1]

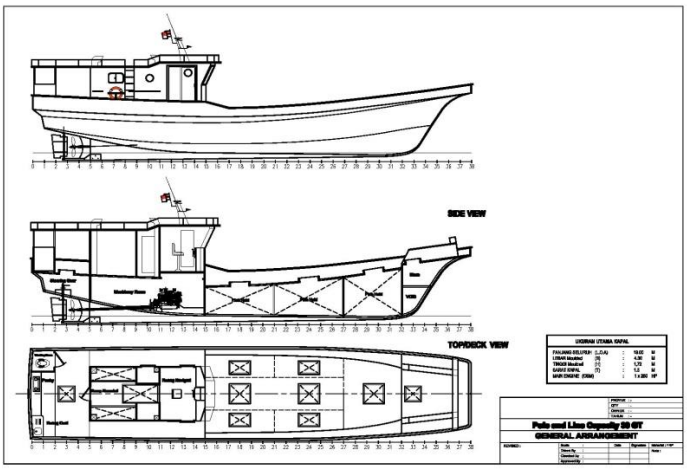


Figure 4.8. MV. Inka Mina 438 General Arrangement[2]

As it can be seen on Table 4.1. there are some data of technical specification of MV. Inka Mina 438 which has collected from PT. F1 Perkasa in banyuwangi.

[1] Collected Data from PT. F1 Perkasa
[2] Collected Data from PT. F1 Perkasa

Table 4.1. Technical Specification Data of Fishing vessel >30GT

Technical Specification of Fishing Vessel >30GT		
Loa	18.5	m
Breadth (B)	4.15	m
Height (H)	2.1	m
Draft (T)	1.2	m
Gross Tonnage (GT)	>30	GT
Main Engine	180-220	HP
Genset	2 x 7	Kw
Fish Cargo Hold	14	m3
Freshwater Tank	1500	litre
Fuel Oil Tank	4000	litre
Service Speed	8	knot
Operational Maximum Reach	60	mile
Ship Crew	7-10	crews

4.3 Tuna Long Liner Fishing Scenario

Fishing scenario is very important before carried out the feasibility analysis of tuna long liner. Because, this scenario will very helpful to determined the assumption and parameter for continuous analysis. Based on Figure 4.8. the actual fishing ground is located around FMA (Fisheries Management Area) number 573.

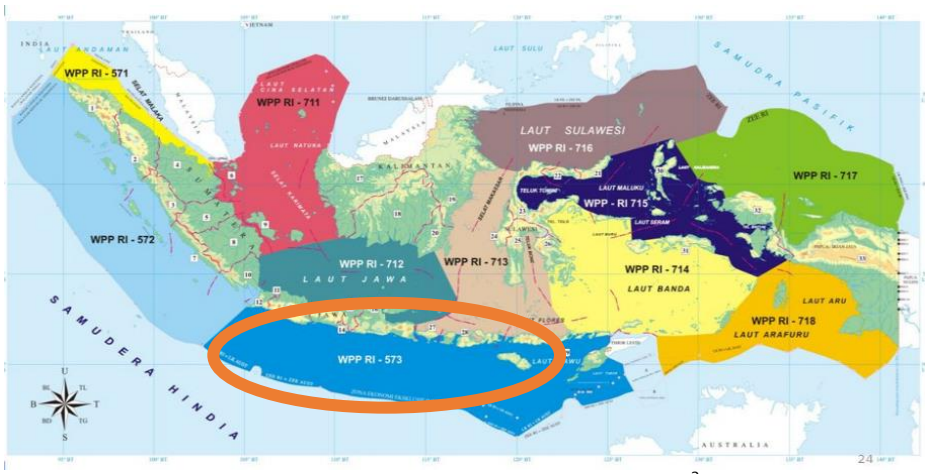


Figure 4.9. Fisheries Management Area 573[3]

[3] bppl.kkp.go.id

As it can be seen on the Table 4.2., there will be explained about the fishing scenario such as fishing home port located in PPS Cilacap, total allowance catch in fishing ground which is 776.29 ton per year based on the MSY value is 970.37 ton per year, and another things considered as part of fishing scenario.

Table 4.2. Fishing scenario

No	Scenario Description		
1	Home Port	PPS Cilacap	
2	Fishing Ground	Java South Sea / FMA 573	
3	MSY (Maximum Sustainable Yield)	970.37	Ton / year
4	TAC (Total Allowance Catch)	776.29	Ton / year
5	Ship Cargo Hold	6.3	Ton
6	Maximum Trip	123	Trips / year
7	Distance to Fishing Ground	97	Km
8	Vessel Speed	8	Knot
9	Time to Reach Fishing Ground	6.5	Hours
10	Fishing Operation :		
	a. CPUE	0.2	Kg / hook
	b. Hook	1500	Hooks
	c. Once Longlining Production	300	Kg
	d. Target Catch	6300	Kg
	e. Longlining Repetition	21	Repetitions
	f. Time for Longlining	12	Hours
	g. Ship Operational Time	11	Days

4.4 Assumption and Parameter for Financial Analysis

To simplify the feasibility analysis in tuna long liner activity there will be used some assumptions and parameters. These assumptions were obtained from tuna long liner activitites in Cilacap District.

As it can be seen on the Table 4.3., the tuna long liner project period determined for 5 years. With fishing vessel economic period is 10 years, and there will be 8 crews on board. Based on the fish price data collected in PPS Cilacap, the fish price that will be used for revenue estimation is Rp 40,000 per kg.

Table 4.3. Assumptions for financial analysis

No	Assumption	Unit	Value / Amount
1	Project period	Years	5
2	Fishing vessel economic period	Years	10
3	Work month for year	Months	12
4	Fish price	Rp / kg	40,000

Table 4.3. Assumptions for financial analysis (continued)

5	Crews	Persons	8
6	Interest rate per year	%	12%
7	Capital proportion :		
	a. Credit from bank	%	70%
	b. Self-funded	%	30%
8	Credit time period	Years	3

4.5 Cost Component and Cost Structure

4.5.1 Capital Expenditure of Long Liner Fishing Vessel with FRP Construction > 30 GT

Based on the Table 4.4., there are some data of capital expenditure of fishing vessel >30 GT with FRP construction which consists of ship building cost of MV. Inka Mina 438 should be paid.

Table 4.4. Capital Expenditure of Long Liner Fishing Vessel with FRP Construction >30GT

No	Description	Total Cost (Rupiah)	Percentage
1	Body Casco of Fiberglass Vessel	Rp 515,000,000	37.39 %
2	Installations	Rp 21,000,000	1.52 %
3	Accomodation	Rp 75,988,000	5.51 %
4	Electrical Equipments	Rp 14,063,000	1.02 %
5	Safety Equipments	Rp 8,308,500	0.60 %
6	Navigation and Communication Equipments	Rp 63,536,500	4.61 %
7	Anchoring and Mooring Equipment	Rp 198,633,000	14.42 %
8	Machinery, Pump, and Installation	Rp 339,516,500	24.65 %
9	Other Cost	Rp 141,150,000	10.25 %
	Sub Total	Rp 1,377,195,500	100 %
	PPN 10 %	Rp 137,719,550	10 %
	Total 1 Unit of Vessel	Rp 1,514,915,050	110 %

4.5.2 Component of Investment Project Capital

Total project cost needed for ship building of MV. Inka Mina 438 is Rp 1,514,915,050. Approximately projected 70% will be loaned by financial company such as bank and 30% will be self-funded. All of the investment credit received during construction period with loaning time period is 3 years with interest rate 12% decreased effectively.

Table 4.5. Component and structure of project cost

No	Project Cost Component	Percentage	Total Cost (Rupiah)
1	Credit from Bank	70 %	Rp 1,060,440,535
2	Self-funded	30 %	Rp 454,474,515
Total Investment Project Capital		100 %	Rp 1,514,915,050

Fixed installment and interest installment are paid every month during the loaning time period, in this study was taken 3 years of loaning time period. Recapitulation of credit installment is shown on the Table 4.6., and the detail calculation will be in attachment.

Table 4.6. Credit Installment Recapitulation

Year	Fixed Installment	Interest	Total Installment	Beginning Balance	Ending Balance
				Rp 1,060,440,535	Rp 1,060,440,535
1	Rp 353,480,178	Rp 107,811,454	Rp 461,291,632	Rp 1,060,440,535	Rp 706,960,356
2	Rp 353,480,178	Rp 65,393,832	Rp 418,874,011	Rp 706,960,356	Rp 353,480,178
3	Rp 353,480,178	Rp 22,976,211	Rp 376,456,389	Rp 353,480,178	Rp 0

4.5.3 Operational Expenditure of Tuna Long Liner Fishing Vessel with FRP Construction > 30 GT

Based on the Table 4.7., there are some data of operational cost of fishing vessel >30 GT with FRP construction which consists of fuel cost, fish chiller cost, baiting cost, crew cost, provision cost and port cost should be paid. The operational costs are based on one round trip or 11 days per trip. Operational costs are classified as variable cost because the unit price might be changing according to any conditions. Then, total operational cost and maintenance cost for a year or 33 trips are approximately Rp 2,040,331,000 with assumption in first year until third year of this investment is operated with 100% capacity. The calculated cost is not considering yet the increasing or decreasing of unit price which might be changing according to any conditions happened.

For annual maintenance cost estimation which consists of vessel maintenance, long line fishing gear maintenance, machinery maintenance, and other equipments are presented on the Table 4.8.

Table 4.7. Operational Cost of Long Liner Fishing Vessel with FRP Construction >30GT

No	Operational Cost	Needs per Trip	Unit Price	Cost
1	Fuel	4000 litre	Rp 5,700/litre	Rp 22,800,000
2	Fish Chiller	6.3 ton	Rp 15,000/block	Rp 1,575,000
3	Bait (milkfish)	1100 kg	Rp 18,000/kg	Rp 19,800,000
4	Crew	7 crews	Rp 84,000/day	Rp 7,392,000
5	Provision	11 days	Rp 40,000/day	Rp 440,000
Total				Rp 52,007,000

Table 4.8. Maintenance Cost of Long Liner Fishing Vessel with FRP Construction >30GT

No	Type of Maintenance	Cost	Annual Frequency	Accumulated Cost
1	Vessel	Rp 20,000,000	2	Rp 40,000,000
2	Long Line	Rp 3,000,000	2	Rp 6,000,000
3	Machinery	Rp 10,000,000	2	Rp 20,000,000
4	Other Equipments	Rp 2,000,000	2	Rp 4,000,000
Total				Rp 70,000,000

4.6 Revenue Estimation

The revenue estimation are based on production per trip of fish types and unit price of fish. Yellowfin tuna, big eye tuna, albacore tuna, southern bluefin tuna are target catch of long liner fishing vessel which operated in PPS Cilacap. From the operational scenario, long liner fishing vessel >30 GT estimated to have 33 trips during a year. Revenue estimation of long liner fishing vessel >30 GT with fish landing base in PPS Cilacap is presented on the Table 4.9.

Table 4.9. Revenue Estimation of Long Liner Fishing Vessel >30 GT

Fish Type	Production per Trip (Kg)	Unit Price (Rp/Kg)	Revenue (Rp)
Yellowfin Tuna	396.58 Kg	Rp 40,000	Rp 15,863,200
Big Eye Tuna	291.05 Kg	Rp 40,000	Rp 11,642,000
Albacore Tuna	1224.96 Kg	Rp 40,000	Rp 48,998,400
Southern Bluefin Tuna	35.77 Kg	Rp 40,000	Rp 1,430,800
Total			Rp 77,934,400
Retribution (3%)			Rp 2,338,032
Revenue after retribution per trip			Rp 75,596,368

Table 4.9. Revenue Estimation of Long Liner Fishing Vessel >30 GT (continued)

Trip per year			33 Trip
One year revenue			Rp 2,494,680,144

4.7 Profit/Loss Projection and Break Even Point

Projection of profit/loss shows that this investment has already produce profit (after tax) during first year (with 100% capacity) approximately Rp 381,774,257 with value of profit on sales is 15.3% and the profit increasing until fifth year with amount approximately Rp 473,413,993 with profit on sales is 18.9%. The profit/loss projection is shown in the Table 4.10.

Table 4.10. Profit/Loss Projection

No	Description	Year				
		1	2	3	4	5
A	Revenue					
	Total Revenue	**Rp 2,494,680,144**	**Rp 2,494,680,144**	**Rp 2,494,680,144**	**Rp 2,494,680,144**	**Rp 2,494,680,144**
B	Expenditure					
	i. Variable Cost	Rp 1,786,231,000	Rp 1,786,231,000	Rp 1,786,231,000	Rp 1,786,231,000	Rp 1,786,231,000
	ii. Depreciation	Rp 151,491,505	Rp 151,491,505	Rp 151,491,505	Rp 151,491,505	Rp 151,491,505
	iii. Interest Installment	Rp 107,811,454	Rp 65,393,832	Rp 22,976,211	-	-
	Total Expenditure	**Rp 2,045,533,959**	**Rp 2,003,116,337**	**Rp 1,960,698,716**	**Rp 1,937,722,505**	**Rp 1,937,722,505**
C	P/L Before Tax	Rp 449,146,185	Rp 491,563,807	Rp 533,981,428	Rp 556,957,639	Rp 556,957,639
D	Tax (15%)	Rp 67,371,927	Rp 73,734,571	Rp 80,097,214	Rp 83,543,645	Rp 83,543,645
E	P/L After Tax	Rp 381,774,257	Rp 417,829,235	Rp 453,884,213	Rp 473,413,993	Rp 473,413,993
F	Profit on Sales (%)	15.30	16.75	18.19	18.98	18.98
G	BEP : Rupiah	Rp 1,440,239,202	Rp 1,100,690,360	Rp 815,086,675	Rp 678,548,641	Rp 678,548,641
H	BEP : Kg	36,005	27,517	20,377	16,963	16,963

Commonly, fishing activities using long liner fishing gear during 5 years period are generating average profit Rp 440,063,138 and the average profit margin is 17.64%. By comparing the expenditure for fixed cost with variable cost and total revenue, then Break Even Point for this investment occur when the average sales is Rp 944,622,704 or 23,565 kg. Table 4.11 shows the average profit and Break Even Point (BEP).

Table 4.11. Average Profit and Break Even Point

Profit per year	Rp 440,063,138
Profit Margin (%)	17.64
BEP : Rupiah	Rp 942,622,704
BEP : Kg	23,565

4.8 Cash Flow Projection and Project Feasibility

Profitability evaluation of investment is carried out by assessing the investment criteria to measure the investment feasibility including NPV (Net Present Value), IRR (Internal Rate of Return), Net B/C Ratio (Net Benefit-Cost Ratio). The Investment of long liner fishing vessel assessed by using any assumptions and parameters will resulting of NPV Rp 568,394,954 when the interest rate is 12%. The value of IRR is 23%, Net B/C Ratio is 1.07 and the Payback Period reached in 4.4 years. Project feasibility of long liner fishing vessel is shown in the Table 4.12.

Table 4.12. Project Feasibility of Long Liner Fishing Vessel

No	Criteria	Value	Feasibility Justification
1	NPV (Interest Rate 12%)	Rp 568,394,954	>0
2	IRR	23%	>12%
3	Net B/C Ratio	1.07	>1
4	Payback Period	4.4 years	<5 years

4.9 Sensitivity Analysis of Project Feasibility

Two important factors in project feasibility analysis are variable cost / operational cost and income / revenue. The changing of those two factors are greatly affect the health of investment. To evaluate the sensitivity level of project by consider the changing variable cost and unit price for sales, should be carried out sensitivity analysis by assessing any changes of variable cost and fish price unit which could affect the income.

This analysis purpose is to reduce the risks of investment project failure. There will be three scenario sensitivity to be analyzed :

4.9.1 Scenario 1 (Variable Cost Rises)

This scenario will assessing about the changing of variable cost with assumption the income / revenue is fixed. The rising of variable cost is

caused by the present economic development and fuel cost rises then generate assumption about variable cost rises. Other factors which could affect the changing of variable cost are fish chiller price, bait price, crews salary, provision price, and maintenance cost. Each of these factors has dynamic price which might be change anytime according to specific conditions.

Based on the Table 4.13. and 4.14. the result of sensitivity analysis caused by the rise of variable cost shows that variable cost rising up to 5% is still feasible to proceed the investment. Meanwhile, variable cost rising up to 6% is not eligible anymore to continue the investment.

Table 4.13. Sensitivity Analysis : Variable Cost Rises 5%

No	Criteria	Value	Feasibility Justification
1	NPV (Interest Rate 12%)	Rp 36,605,599	>0
2	IRR	13%	>12%
3	Net B/C Ratio	1.00	>1
4	Payback Period	5.0 years	<5 years

Table 4.14. Sensitivity Analysis : Variable Cost Rises 6%

No	Criteria	Value	Feasibility Justification
1	NPV (Interest Rate 12%)	- Rp 69,752,271	<0
2	IRR	11%	<12%
3	Net B/C Ratio	0.992	<1
4	Payback Period	5.2 years	>5 years

With variable cost rises up to 5%, Net B/C Ratio is still feasible because the ratio is not less than one, NPV value is positive, IRR reaching to 13% which is higher than the interest rate and Payback Period 5.0 years. While it rising up to 6% level the Net B/C Ratio is less than one, NPV value is negative, IRR reaching to 11% which is lower than interest rate, the Payback Period 5.2 years, those factors showing that variable cost rises up to 6% is not feasible to continue the investment. Then, the safe range of variable cost rises is 0% - 5% for feasible investment.

4.9.2 Scenario 2 (Income Down)

On this second scenario will assessing about the changing of income / revenue with assumption the variable cost is fixed. Decreasing of income

is caused by the slope of tuna long line product quality or fish price is declined then generate assumption about income down.

As it can be seen on the Table 4.15. and 4.16 the result of sensitivity analysis caused by income down shows that declining income up to 3% is still feasible to proceed the investment. Meanwhile, declining income to 4% is not eligible anymore to continue the investment.

Table 4.15. Sensitivity Analysis : Income Down 3%

No	Criteria	Value	Feasibility Justification
1	NPV (Interest Rate 12%)	Rp 122,771,400	>0
2	IRR	14%	>12%
3	Net B/C Ratio	1.02	>1
4	Payback Period	4.9 years	<5 years

Table 4.16. Sensitivity Analysis : Income Down 4%

No	Criteria	Value	Feasibility Justification
1	NPV (Interest Rate 12%)	- Rp 25,769,784	<0
2	IRR	11%	<12%
3	Net B/C Ratio	0.997	<1
4	Payback Period	5.1 years	>5 years

With income down to 3%, Net B/C Ratio is still feasible because the ratio is not less than one, NPV value is positive, IRR reaching to 14% which is higher than the interest rate and Payback Period 4.9 years. While it declined to 4% level the Net B/C Ratio is less than one, NPV value is negative, IRR reaching to 11% which is lower than interest rate, the Payback Period 5.1 years, those factors showing that income declined to 4% is not feasible to continue the investment. Then, the safe range of income to be decreased is 0% - 3% for feasible investment.

4.9.3 Scenario 3 (Combination)

For the third scenario will assessing the combination assumption from scenario 1 and 2. Then, in this scenario there is no need to assume because solely combine the assumption between variable cost rises and income down.

As shown on the Table 4.17. and 4.18. the result of sensitivity analysis caused by the rise of variable cost and declined income for each 2% shows that those conditions are still feasible to proceed the investment.

Meanwhile, the combination of variable cost rising up to 3% and income down to 3% are not eligible anymore to continue the investment.

Table 4.17. Sensitivity Analysis : Variable Cost Rises 2% and Income Down 2%

No	Criteria	Value	Feasibility Justification
1	NPV (Interest Rate 12%)	Rp 58,596,843	>0
2	IRR	13%	>12%
3	Net B/C Ratio	1.01	>1
4	Payback Period	5.0 years	<5 years

Table 4.18. Sensitivity Analysis : Variable Cost Rises 3% and Income Down 3%

No	Criteria	Value	Feasibility Justification
1	NPV (Interest Rate 12%)	- Rp 196,302,212	<0
2	IRR	8%	<12%
3	Net B/C Ratio	0.98	<1
4	Payback Period	5.3 years	>5 years

With first combination which is variable cost rises up to 2% and income down to 2%, Net B/C Ratio is still feasible because the ratio is not less than one, NPV value is positive, IRR reaching to 13% which is higher than the interest rate and Payback Period 5.0 years. While those declined to 3% level the Net B/C Ratio is less than one, NPV value is negative, IRR reaching to 8% which is lower than interest rate, the Payback Period 5.3 years, those factors showing that variable cost rises up to 3% and income declined to 3% are not feasible to continue the investment. Then, the safe range of combination assessment is 0% - 2% for feasible investment.

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CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Based on the analysis of this research study which refer to data analysis results and others information, then some conclusions could be taken as explained below :

1. From the data which has been obtained and processed from 2010 – 2014 of long liner fishing vessel productivity, during five years the average of tuna productivity in fishing port PPS Cilacap shown that Big Eye Tuna had the highest average of productivity amount with catch effort 156,26 per unit and the productivity level was 14787,8 ton. The second highest was Albacore Tuna with catch effort 135,03 unit and the productivity level was 5379,04 ton. Then, there was Yellowfin Tuna with catch effort 96,86 unit and productivity level 2537,194. The lowest average of productivity was Southern Bluefin Tuna with catch effort 1,738 unit and the productivity level solely 47,59 ton.
2. Total project cost needed for ship building of MV. Inka Mina 438 is Rp 1,514,915,050. Approximately projected 70% will be loaned by financial company such as bank and 30% will be self-funded. Then, total credit proposed is Rp 1,060,440,535.
3. Total operational cost and maintenance cost for a year or 33 trips are approximately Rp 2,040,331,000 with assumption in first year until third year of this investment is operated with 100% capacity. The calculated cost is not considering yet the increasing or decreasing of unit price which might be changing according to any conditions happened.
4. Fishing activities using long liner fishing gear during 5 years period are generating average profit Rp 440,063,138 and the average profit margin is 17.64%. By comparing the expenditure for fixed cost with variable cost and total revenue, then Break Even Point for this investment occur when the average sales is Rp 944,622,704 or 23,565 kg.
5. The Investment of long liner fishing vessel is feasible to carried out after assessed by using any assumptions and parameters will resulting of NPV Rp 568,394,954 when the interest rate is 12%. The value of IRR is 23%, Net B/C Ratio is 1.07 and the Payback Period reached in 4.4 years.

5.2 Recommendation

Based on the previous conclusion, there are some recommendations could be use as consideration for the next research :

1. This investment project is feasible by considering some factors such as raw materials potential, tuna fisheries productivity, and financial aspect.
2. Should be carried out feasibility study of long liner fishing vessel in different fish management area for development of tuna fisheries productivity in Indonesia.
3. Technical detail analysis of FRP construction for long liner fishing vessel could be taken for the next research.

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ATTACHMENT 1
CPUE CALCULATION OF TUNA PRODUCTIVITY

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Yellowfin Tuna			
Year	Production (Ton)	Effort (Trip)	CPUE (Ton / Trip)
2010	1374,3	135	10,18
2011	7106,46	166	42,81
2012	1850,2	110	16,82
2013	925,76	44	21,04
2014	1429,25	29,3	48,77986348
Average	2537,194	96,86	27,9259727

Big Eye Tuna			
Year	Production (Ton)	Effort (Trip)	CPUE (Ton / Trip)
2010	62272	224	278
2011	4809,4	278	17,3
2012	4014,5	185	21,7
2013	2116,4	74	28,6
2014	726,74	20,3	35,8
Average	14787,808	156,26	76,28

Albacore Tuna			
Year	Production (Ton)	Effort (Trip)	CPUE (Ton / Trip)
2010	9340,62	165,35	56,48999093
2011	3009,8	202	14,89262741
2012	3079,44	136,5	22,56
2013	5981	134,8	44,3694362
2014	5484,38	36,4	150,6697802
Average	5379,048	135,03	57,79636695

Southern Bluefin Tuna			
Year	Production (Ton)	Effort (Trip)	CPUE (Ton / Trip)
2010	50,86	2,72	18,69852941
2011	40,82	2	16,52631579
2012	126,67	2,8	45,23928571
2013	19,55	0,68	28,75
2014	0,08	0,02	4
Average	47,596	1,738	22,64282618

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ATTACHMENT 2
MV. INKA MINA 438 GENERAL ARRANGEMENT

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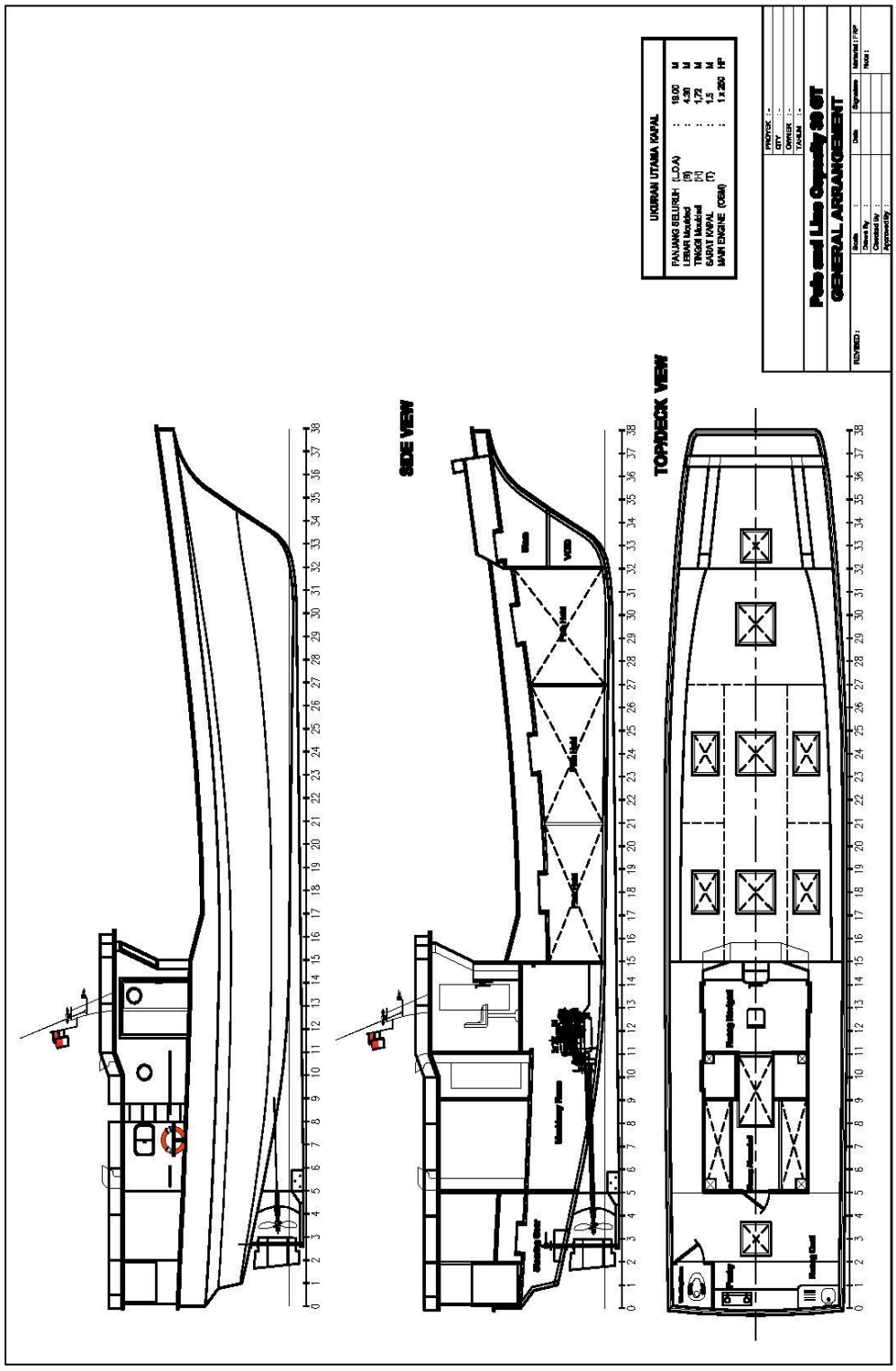
UKURAN UTAMA KAPAL
PANJANG SELURUH (LOA) : 19.00 M
LEBAR Moulded (B) : 4.30 M
TINGGI Moulded (H) : 1.72 M
SARAT KAPAL (T) : 1.5 M
MAIN ENGINE (KBM) : 1 x 260 HP
SIDE VIEW
TOP/DECK VIEW
Pole and Line Capacity 30 GT
GENERAL ARRANGEMENT

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ATTACHMENT 3
CAPITAL EXPENDITURE

CAPITAL EXPENDITURE OF FRP FISHING VESSEL >30GT						
A. KASKO KAPAL						
NO	PEMAKAIAN BAHAN	Merek / Type	Jumlah	Satuan	Harga Satuan	Jumlah Harga
1	Body Kasko Kapal		1	Lot	IDR 515.000.000,00	IDR 515.000.000,00
TOTAL HARGA						IDR 515.000.000,00
B. BIAYA PERLENGKAPAN DAN PERALATAN KAPAL						
NO	PEMAKAIAN BAHAN	Merek / Type	Jumlah	Satuan	Harga Satuan (Rp)	Jumlah Harga (Rp)
III	INSTALASI - INSTALASI					
1	Instalasi Listrik	Kabel marine	1	Lot	IDR 15.000.000,00	IDR 15.000.000,00
	Instalasi Pipa Air Tawar	Pipa PVC	1	Lot	IDR 1.500.000,00	IDR 1.500.000,00
	Instalasi Pipa Air Laut	Pipa Galvanis	1	Lot	IDR 1.500.000,00	IDR 1.500.000,00
	Instalasi Pipa bahan bakar	Pipa Galvanis	1	Lot	IDR 1.500.000,00	IDR 1.500.000,00
	Instalasi Pipa gas buang	Pipa Galvanis	1	Lot	IDR 1.500.000,00	IDR 1.500.000,00
TOTAL HARGA						IDR 21.000.000,00
IV	AKOMODASI					
1	Jendela, Pintu dan Tangga	Standart	1	Lot	IDR 10.890.000,00	IDR 10.890.000,00
2	Plafon dan dinding	Standart	1	Lot	IDR 7.260.000,00	IDR 7.260.000,00
3	Railing atas cabin	Galvanis 1,25 i	1	Lot	IDR 8.470.000,00	IDR 8.470.000,00
4	Locker Ruang Navigasi	Standart	4	Set	IDR 847.000,00	IDR 3.388.000,00
5	Toilet jongkok dan Perlengkapannya	Standart	1	Lot	IDR 1.028.500,00	IDR 1.028.500,00
6	Kursi Nahkoda	Fiberglass + bu	1	Set	IDR 302.500,00	IDR 302.500,00
7	Rak / Lemari Dapur	Fiberglass	1	Set	IDR 605.000,00	IDR 605.000,00
8	Washtafel	Fiberglass	1	Set	IDR 605.000,00	IDR 605.000,00
9	Peralatan Dapur / Makan	Standart	1	Set	IDR 1.815.000,00	IDR 1.815.000,00
10	Tabung Gas 3 Kg	Standart	2	Unit	IDR 121.000,00	IDR 242.000,00
11	Tempat Tidur Dan Perlengkapannya	Fiberglass	1	Set	IDR 1.936.000,00	IDR 1.936.000,00
12	Tiang Bendera	Galvanis	1	Set	IDR 121.000,00	IDR 121.000,00
13	Tutup Palkah Ikan (Ganda)	Fiberglass	1	Shipset	IDR 2.420.000,00	IDR 2.420.000,00
14	Polyurhetane Foam	Standart	1	Shipset	IDR 24.200.000,00	IDR 24.200.000,00
15	Tutup Palkah Jaring	Fiberglass	1	Shipset	IDR 605.000,00	IDR 605.000,00
16	Pengecatan Interior, Eksterior Dan Ar	Standart	1	Shipset	IDR 12.100.000,00	IDR 12.100.000,00
TOTAL HARGA						IDR 75.988.000,00
V	PERALATAN LISTRIK DAN PENERANGAN					
1	Distribution box AC 220 V - 380 V	Baja	1	Set	IDR 1.500.000,00	IDR 1.500.000,00
2	Distribution box 24 V DC	Baja	1	Set	IDR 1.000.000,00	IDR 1.000.000,00
3	Main Switchboard AC/220/380 V Pane	Baja	1	Set	IDR 300.000,00	IDR 300.000,00
4	Panel Switchboard DC	Switch on/off +	1	Set	IDR 750.000,00	IDR 750.000,00
5	Accu 120 AH, 12 V + Kepala accu	Standart	2	Buah	IDR 1.573.000,00	IDR 3.146.000,00
6	Battery Charger AC 220 V	Standart	1	Buah	IDR 1.815.000,00	IDR 1.815.000,00
7	Battery Switch	Switch on/off	1	Buah	IDR 450.000,00	IDR 450.000,00
8	Shore Connection	Standart	1	Set	IDR 1.452.000,00	IDR 1.452.000,00
9	Lampu Penerangan AC 220 V 20 Watt	Standart	7	Set	IDR 100.000,00	IDR 700.000,00
10	Lampu Penerangan DC 24 V	Dome Light	3	Set	IDR 200.000,00	IDR 600.000,00
11	Lampu Kamar Mesin AC 220 V 20 Watt	Water resistar	2	Buah	IDR 100.000,00	IDR 200.000,00
12	Lampu Navigasi DC 24 V	type 55	5	Buah	IDR 250.000,00	IDR 1.250.000,00
13	Lampu Sorot DC 24 V 200 Watt	Standart	1	Set	IDR 300.000,00	IDR 300.000,00
14	Lampu Kerja Halogen 150 Watt	Standart	4	Buah	IDR 150.000,00	IDR 600.000,00
TOTAL HARGA						IDR 14.063.000,00
VI	PERALATAN KESELAMATAN					
1	Ring Bouy dengan Tali 30 meter	Standart	2	Buah	IDR 450.000,00	IDR 900.000,00
2	Life Jacket	Solas	15	Buah	IDR 175.000,00	IDR 2.625.000,00
3	Tabung Pemadam kebakaran kap. 4,5	Dry Powder	3	Buah	IDR 544.500,00	IDR 1.633.500,00
4	Parachute Signal	Standart	4	Buah	IDR 250.000,00	IDR 1.000.000,00
5	Smoke Signal	Standart	2	Buah	IDR 350.000,00	IDR 700.000,00
6	Red hand Flare	Standart	4	Buah	IDR 250.000,00	IDR 1.000.000,00
7	Alat Penangkal Petir (ARDE)	Standart	1	Set	IDR 250.000,00	IDR 250.000,00
8	Kotak Obat (P3K)	Pharmacy	1	Buah	IDR 200.000,00	IDR 200.000,00
TOTAL HARGA						IDR 8.308.500,00

VII	PERALATAN NAVIGASI DAN KOMUNIKASI							
1	Peta Laut	Daerah Pelaya	1	Set	IDR	400.000,00	IDR	400.000,00
2	Meja Peta	Standart	1	Buah	IDR	450.000,00	IDR	450.000,00
3	Lampu Peta	Standart	1	Buah	IDR	350.000,00	IDR	350.000,00
4	Jam Dinding	Standart	1	Buah	IDR	1.100.000,00	IDR	1.100.000,00
5	Teropong (binocular) size 7 x 50 mm	Standart	1	Buah	IDR	750.000,00	IDR	750.000,00
6	Busur Derajat	Standart	1	Buah	IDR	200.000,00	IDR	200.000,00
7	Jangka dan Segitiga peta	Standart	1	Buah	IDR	250.000,00	IDR	250.000,00
8	Mistar Jajar	Standart	1	Set	IDR	200.000,00	IDR	200.000,00
9	Kompas Magnetic 4"	Standart	1	Set	IDR	1.210.000,00	IDR	1.210.000,00
10	Radio VHF marine + antena	Standart	1	Set	IDR	3.100.000,00	IDR	3.100.000,00
11	Radio FM Transceiver + antena	Standart	1	Unit	IDR	11.500.000,00	IDR	11.500.000,00
12	GPS / Chart Plotter	Standart	1	Unit	IDR	7.850.000,00	IDR	7.850.000,00
13	Fish Finder	Standart	1	Unit	IDR	4.300.000,00	IDR	4.300.000,00
14	VMS On Line	Standart	1	Unit	IDR	14.500.000,00	IDR	14.500.000,00
15	Cler View Screen DC 24 Volt dia. 10 in	Standart	1	Unit	IDR	8.500.000,00	IDR	8.500.000,00
16	Bendera Nasional	Merah Putih	1	Buah	IDR	35.000,00	IDR	35.000,00
17	Bendera Isyarat 35 x 45	Standart	1	Set	IDR	450.000,00	IDR	450.000,00
18	Klakson / Horn	Twin type	1	Buah	IDR	750.000,00	IDR	750.000,00
19	White Board	Standart	1	Buah	IDR	200.000,00	IDR	200.000,00
20	Alat Pemanggil Ikan	Standart	4	Buah	IDR	1.815.000,00	IDR	7.260.000,00
21	Clinometer	Standart	1	Buah	IDR	181.500,00	IDR	181.500,00
TOTAL HARGA							IDR	63.536.500,00
VIII	PERALATAN LABUH DAN TAMBAT							
1	Tali Jangkar dia. 9 mm (Kawat Baja)	Kawat	50	Mtr	IDR	95.000,00	IDR	4.750.000,00
2	Jangkar Ukuran 30 kg Galvanis	Galvanize	1	Buah	IDR	1.270.500,00	IDR	1.270.500,00
3	Rantai Jangkar dia. 1/2"	Galvanize	3	Mtr	IDR	302.500,00	IDR	907.500,00
4	Roller Jangkar	Baja	1	Buah	IDR	3.630.000,00	IDR	3.630.000,00
5	Tali Tambat dia. 16 mm PPD	PPD	100	Mtr	IDR	25.000,00	IDR	2.500.000,00
6	Tali Buang dia. 10 mm panjang 20 mt	PPD	2	Set	IDR	150.000,00	IDR	300.000,00
7	Bolder stainless steel	Stainless stee	4	Buah	IDR	2.420.000,00	IDR	9.680.000,00
8	Anchor Windlass (Manual)	Standart	1	Set	IDR	4.235.000,00	IDR	4.235.000,00
9	Daprah Kapsul Polyform	Capsule Polyfo	4	Buah	IDR	500.000,00	IDR	2.000.000,00
10	Alat Tangkap Ikan	Longline	1	Set	IDR	150.000.000,00	IDR	150.000.000,00
11	Wind Net Hauler dengan engine dan	Standart	1	Set	IDR	19.360.000,00	IDR	19.360.000,00
TOTAL HARGA							IDR	198.633.000,00
IX	PERMESINAN, POMPA DAN INSTALASI							
1	Mesin Induk Marine diesel 180-220 H	Marine diesel	1	Set	IDR	185.000.000,00	IDR	185.000.000,00
2	Mesin Bantu 7 KW	Diesel genset	2	Unit	IDR	15.125.000,00	IDR	30.250.000,00
3	Pondasi mesin utama dan genset	Baja	1	Shipset	IDR	6.050.000,00	IDR	6.050.000,00
4	Exhaust mesin utama dan genset + i	Baja + Insulati	1	Shipset	IDR	7.260.000,00	IDR	7.260.000,00
5	Shafting, Stern tube & propeller	Marine Standa	1	Set	IDR	45.000.000,00	IDR	45.000.000,00
6	Rudder Construction (blade & tongka	Baja	1	Set	IDR	9.075.000,00	IDR	9.075.000,00
7	Steering gear sistem (lengkap)	Hydraulic + kal	1	Set	IDR	26.620.000,00	IDR	26.620.000,00
8	Roda Kemudi	Marine Standa	1	Set	IDR	500.000,00	IDR	500.000,00
9	Lever control Egine	Marine Standa	1	Set	IDR	6.050.000,00	IDR	6.050.000,00
10	Rudder angle indicator	Standart	1	Set	IDR	3.630.000,00	IDR	3.630.000,00
11	Bilge pump DC 24 V dengan automat	1500 GHP + aut	2	Set	IDR	968.000,00	IDR	1.936.000,00
12	Pompa Air Tawar	Sanyo	1	Set	IDR	907.500,00	IDR	907.500,00
13	Pelindung panas di ruang mesin	Al foil + Glassv	1	Set	IDR	2.420.000,00	IDR	2.420.000,00
14	Pompa tangan manual	Manual	1	Set	IDR	363.000,00	IDR	363.000,00
15	Pompa AC 220 Volt	Standart	1	Set	IDR	605.000,00	IDR	605.000,00
16	Tool Kit	Kunci - kunci ta	1	Set	IDR	850.000,00	IDR	850.000,00
17	Blower 10 inch	In dan Out	2	Buah	IDR	4.000.000,00	IDR	8.000.000,00
18	Plat baja pada linggi kemudi	Baja 9 mm x 5"	1	Shipset	IDR	5.000.000,00	IDR	5.000.000,00
TOTAL HARGA							IDR	339.516.500,00

C. BIAYA JASA PIHAK LAIN							
Job Description		: Jasa - jasa					
Reference Plan		: -					
Tabel 9. Biaya Jasa Lain							
NO	PEMAKAIAN BAHAN	Merek / Type	Jumlah	Satuan	Harga Satuan (Rp)	Jumlah Harga (Rp)	
I	SURAT - SURAT KAPAL						
1	Surat Ukur Sementara	Syahbandar	1	Lot	IDR 3.000.000,00	IDR	3.000.000,00
2	Surat Dokumen Kapal	Syahbandar	1	Lot	IDR 7.000.000,00	IDR	7.000.000,00
3	Surat Izin Usaha Perikanan (SIUP)	KKP	1	Lot	IDR 5.000.000,00	IDR	5.000.000,00
4	Surat Izin Penangkapan Ikan (SIPI)	KKP	1	Lot	IDR 10.000.000,00	IDR	10.000.000,00
TOTAL HARGA						IDR	25.000.000,00
II	BIAYA MONITORING KUB KE GALANGAN						
1	Tiket Perjalanan	2 Org	3	Trip	IDR 2.300.000,00	IDR	6.900.000,00
2	Akomodasi	2 Org	3	Trip	IDR 1.000.000,00	IDR	3.000.000,00
TOTAL HARGA						IDR	9.900.000,00
III	PELUNCURAN / LAUNCHING						
1	Dudukan Peluncuran	Lori / rel	1	Lot	IDR 5.000.000,00	IDR	5.000.000,00
2	Peralatan	Takal / kren	1	Lot	IDR 2.000.000,00	IDR	2.000.000,00
3	Tenaga Kerja	Man Power	10	Orang	IDR 300.000,00	IDR	3.000.000,00
TOTAL HARGA						IDR	10.000.000,00
IV	PERCOBAAN BERLAYAR / SEA TRIAL						
1	Bahan Bakar Minyak	Solar	200	Liter	IDR 9.000,00	IDR	1.800.000,00
2	Pelumas	Oli	10	Liter	IDR 35.000,00	IDR	350.000,00
3	ABK	Crew	4	Orang	IDR 200.000,00	IDR	800.000,00
TOTAL HARGA						IDR	2.950.000,00
V	OPERASIONAL 1 TRIP						
1	Bahan Bakar Minyak	Solar	3000	Liter	IDR 9.000,00	IDR	27.000.000,00
2	Pelumas	Oli	10	Liter	IDR 35.000,00	IDR	350.000,00
TOTAL HARGA						IDR	27.350.000,00
VI	PENGIRIMAN DELIVERY						
1	Biaya Pengiriman	Standart	1	Lot	IDR 55.000.000,00	IDR	55.000.000,00
TOTAL HARGA						IDR	55.000.000,00
VII	LAIN - LAIN						
1	Cek Fisik Kapal	KKP	1	Set	IDR 5.000.000,00	IDR	5.000.000,00
2	Miniatur Kapal	Standart	1	Set	IDR 3.000.000,00	IDR	3.000.000,00
TOTAL HARGA						IDR	8.000.000,00

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ATTACHMENT 4
OPERATIONAL EXPENDITURE

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Operational Cost	Needs Per Trip		Unit Price		Cost
Fuel	4000	litre	IDR 5.700	litre	IDR 22.800.000
Fish Chiller	6,3	ton	IDR 15.000	block (60 kg)	IDR 1.575.000
Bait (Milkfish)	1100	kg	IDR 18.000	kg	IDR 19.800.000
Crew	8	crews	IDR 84.000	day	IDR 7.392.000
Provision	11	days	IDR 40.000	day	IDR 440.000
Total Per Trip					IDR 52.007.000

Type of Maintenance	Cost	Annual Frequency	Accumulated Cost
Vessel	IDR 20.000.000	2	IDR 40.000.000
Long Line	IDR 3.000.000	2	IDR 6.000.000
Machinery	IDR 10.000.000	2	IDR 20.000.000
Other Equipments	IDR 2.000.000	2	IDR 4.000.000
Total			IDR 70.000.000

Annual OPEX	
33 Trips (Operational)	IDR 1.716.231.000
Maintenance	IDR 70.000.000
Total	IDR 1.786.231.000

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ATTACHMENT 5
FISHING SCENARIO

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Operating Ground

Java South Sea
FMA 573

MSY	970,37	ton/year
TAC	776,296	ton/year

Fishing Days

TAC	776,296	ton/year	776,296	ton/year	
Ship Cargo Hold	6,3	ton	6,3	ton/voyage	
Maximum Trip	123,2215873	voyage/year	123	voyage/year	

Fishing Operation

Distance to Fishing Ground based on fisheries management area	97	km
Vessel Speed	8	knot
Time	23571,15086	S
	6,547541904	hours

Approximately needs 6,5 hours to fishing ground

CPUE	0,2	kg/hook			
Hook	1500	hook			
Once longline	300	kg			
Catch Target	6,3	ton	6300	kg	
Longline Repetition	21	Repetitions			

Setting Longline		4	hours		
Waiting		3	hours		
Hauling and Landing Catch		5	hours		
		12	hours		
Whole operation takes time		252	hours	10,5	day

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ATTACHMENT 6
CREDIT INSTALLMENT

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Credit Installment of Investment (Interest Rate 12%)						
Period	**Credit**	**Fixed Installment**	**Interest**	**Total**	**Beginning Balance**	**Ending Balance**
Year -0	1.060.440.535,00				1.060.440.535,00	1.060.440.535,00
Month -1		29.456.681,53	10.604.405,35	40.061.086,88	1.060.440.535,00	1.030.983.853,47
Month -2		29.456.681,53	10.309.838,53	39.766.520,06	1.030.983.853,47	1.001.527.171,94
Month -3		29.456.681,53	10.015.271,72	39.471.953,25	1.001.527.171,94	972.070.490,42
Month -4		29.456.681,53	9.720.704,90	39.177.386,43	972.070.490,42	942.613.808,89
Month -5		29.456.681,53	9.426.138,09	38.882.819,62	942.613.808,89	913.157.127,36
Month -6		29.456.681,53	9.131.571,27	38.588.252,80	913.157.127,36	883.700.445,83
Month -7		29.456.681,53	8.837.004,46	38.293.685,99	883.700.445,83	854.243.764,31
Month -8		29.456.681,53	8.542.437,64	37.999.119,17	854.243.764,31	824.787.082,78
Month -9		29.456.681,53	8.247.870,83	37.704.552,36	824.787.082,78	795.330.401,25
Month -10		29.456.681,53	7.953.304,01	37.409.985,54	795.330.401,25	765.873.719,72
Month -11		29.456.681,53	7.658.737,20	37.115.418,73	765.873.719,72	736.417.038,19
Month -12		29.456.681,53	7.364.170,38	36.820.851,91	736.417.038,19	706.960.356,67
Year -1		**353.480.178,33**	**107.811.454,39**	**461.291.632,73**		
Month -1		29.456.681,53	7.069.603,57	36.526.285,09	706.960.356,67	677.503.675,14
Month -2		29.456.681,53	6.775.036,75	36.231.718,28	677.503.675,14	648.046.993,61
Month -3		29.456.681,53	6.480.469,94	35.937.151,46	648.046.993,61	618.590.312,08
Month -4		29.456.681,53	6.185.903,12	35.642.584,65	618.590.312,08	589.133.630,56
Month -5		29.456.681,53	5.891.336,31	35.348.017,83	589.133.630,56	559.676.949,03
Month -6		29.456.681,53	5.596.769,49	35.053.451,02	559.676.949,03	530.220.267,50
Month -7		29.456.681,53	5.302.202,68	34.758.884,20	530.220.267,50	500.763.585,97
Month -8		29.456.681,53	5.007.635,86	34.464.317,39	500.763.585,97	471.306.904,44
Month -9		29.456.681,53	4.713.069,04	34.169.750,57	471.306.904,44	441.850.222,92
Month -10		29.456.681,53	4.418.502,23	33.875.183,76	441.850.222,92	412.393.541,39
Month -11		29.456.681,53	4.123.935,41	33.580.616,94	412.393.541,39	382.936.859,86
Month -12		29.456.681,53	3.829.368,60	33.286.050,13	382.936.859,86	353.480.178,33
Year -2		**353.480.178,33**	**65.393.832,99**	**418.874.011,33**		
Month -1		29.456.681,53	3.534.801,78	32.991.483,31	353.480.178,33	324.023.496,81
Month -2		29.456.681,53	3.240.234,97	32.696.916,50	324.023.496,81	294.566.815,28
Month -3		29.456.681,53	2.945.668,15	32.402.349,68	294.566.815,28	265.110.133,75
Month -4		29.456.681,53	2.651.101,34	32.107.782,87	265.110.133,75	235.653.452,22
Month -5		29.456.681,53	2.356.534,52	31.813.216,05	235.653.452,22	206.196.770,69
Month -6		29.456.681,53	2.061.967,71	31.518.649,23	206.196.770,69	176.740.089,17
Month -7		29.456.681,53	1.767.400,89	31.224.082,42	176.740.089,17	147.283.407,64
Month -8		29.456.681,53	1.472.834,08	30.929.515,60	147.283.407,64	117.826.726,11
Month -9		29.456.681,53	1.178.267,26	30.634.948,79	117.826.726,11	88.370.044,58
Month -10		29.456.681,53	883.700,45	30.340.381,97	88.370.044,58	58.913.363,06
Month -11		29.456.681,53	589.133,63	30.045.815,16	58.913.363,06	29.456.681,53
Month -12		29.456.681,53	294.566,82	29.751.248,34	29.456.681,53	(0,00)
Year -3		**353.480.178,33**	**22.976.211,59**	**376.456.389,93**		

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ATTACHMENT 7
PROFIT LOSS AND BEP CALCULATION

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No	Description	Year				
		1	2	3	4	5
A	Revenue					
	Total Revenue	**2.494.680.144,00**	**2.494.680.144,00**	**2.494.680.144,00**	**2.494.680.144,00**	**2.494.680.144,00**
B	Expenditure					
	i. Variable Cost	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00
	ii. Depreciation	151.491.505,00	151.491.505,00	151.491.505,00	151.491.505,00	151.491.505,00
	iii. Interest Installment	107.811.454,00	65.393.832,00	22.976.211,00	0	0
	Total Expenditure	**2.045.533.959,00**	**2.003.116.337,00**	**1.960.698.716,00**	**1.937.722.505,00**	**1.937.722.505,00**
C	P/L Before Tax	449.146.185,00	491.563.807,00	533.981.428,00	556.957.639,00	556.957.639,00
D	Tax (15%)	67.371.927,75	73.734.571,05	80.097.214,20	83.543.645,85	83.543.645,85
E	P/L After Tax	381.774.257,25	417.829.235,95	453.884.213,80	473.413.993,15	473.413.993,15
F	Profit on Sales (%)	15,30	16,75	18,19	18,98	18,98
G	BEP : Rupiah	1.440.239.202,07	1.100.690.360,10	815.086.675,40	678.548.641,84	678.548.641,84
H	BEP : Kg	36.005,98	27.517,26	20.377,17	16.963,72	16.963,72

Profit per year	440.063.138,66
Profit Margin (%)	17,64
BEP : Rupiah	942.622.704,25
BEP : Kg	23.565,57

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ATTACHMENT 8
CASH FLOW CALCULATION

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No	Description	Year					
		0	1	2	3	4	5
A	**Cash Outflows**						
	1. Capital Expenditure (Shipbuilding Cost)	1.514.915.050,00					
	2. Operational Expenditure (Variable Cost)	-	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00
	3. Fixed Installment	-	353.480.178,00	353.480.178,00	353.480.178,00	-	-
	4. Interest Installment	-	107.811.454,00	65.393.832,00	22.976.211,00	-	-
	Total Cash Outflows	1.514.915.050,00	2.247.522.632,00	2.205.105.010,00	2.162.687.389,00	1.786.231.000,00	1.786.231.000,00
B	**Cash Inflows**						
	1. Earning Before Tax	-	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00
	2. Earning After Tax	-	210.083.885,20	246.138.863,90	282.193.841,75	602.181.772,40	602.181.772,40
	3. Depreciation	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00
	Total Cash Inflows	-151.491.505,00	2.553.272.524,20	2.589.327.502,90	2.625.382.480,75	2.945.370.411,40	2.945.370.411,40
C	**Total Net Cash Flows**	-1.666.406.555,00	305.749.892,20	384.222.492,90	462.695.091,75	1.159.139.411,40	1.159.139.411,40

Year	Expenditure	Revenue	Depreciation	Total Net Cash Flows	Present Value	PV Benefit	PV Cost	Initial Payback
0	-1.514.915.050,00	-	-151.491.505,00	-1.666.406.555,00	-1.666.406.555,00	(151.491.505,00)	1.514.915.050,00	1.666.406.555,00
1	-2.247.522.632,00	2.494.680.144,00	-151.491.505,00	305.749.892,20	272.990.975,18	2.279.707.610,89	2.006.716.635,71	1.360.656.662,80
2	-2.205.105.010,00	2.494.680.144,00	-151.491.505,00	384.222.492,90	306.299.818,96	2.064.196.032,29	1.757.896.213,33	976.434.169,90
3	-2.162.687.389,00	2.494.680.144,00	-151.491.505,00	462.695.091,75	329.337.227,07	1.868.695.392,75	1.539.358.165,69	513.739.078,15
4	-1.786.231.000,00	2.494.680.144,00	-151.491.505,00	1.159.139.411,40	736.654.051,34	1.871.836.144,04	1.135.182.092,71	-645.400.333,25
5	-1.786.231.000,00	2.494.680.144,00	-151.491.505,00	1.159.139.411,40	657.726.831,55	1.671.282.271,47	1.013.555.439,92	-1.804.539.744,65

NPV	568.394.954,54	
IRR	23%	
Net B/C Ratio	1,07	
Payback Period	4,4	Years

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ATTACHMENT 9
SCENARIO 1 CALCULATION (VARIABLE COST RAISES 5%)

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No	Description	Year					
		0	1	2	3	4	5
A	**Cash Outflows**						
	1. Capital Expenditure (Shipbuilding Cost)	1.514.915.050,00					
	2. Operational Expenditure (Variable Cost)	-	1.875.542.550,00	1.875.542.550,00	1.875.542.550,00	1.875.542.550,00	1.875.542.550,00
	3. Fixed Installment	-	353.480.178,00	353.480.178,00	353.480.178,00	-	-
	4. Interest Installment	-	107.811.454,00	65.393.832,00	22.976.211,00	-	-
	Total Cash Outflows	1.514.915.050,00	2.336.834.182,00	2.294.416.560,00	2.251.998.939,00	1.875.542.550,00	1.875.542.550,00
B	**Cash Inflows**						
	1. Earning Before Tax	-	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00
	2. Earning After Tax	-	134.169.067,70	170.224.046,40	206.279.024,25	526.266.954,90	526.266.954,90
	3. Depreciation	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00
	Total Cash Inflows	-151.491.505,00	2.477.357.706,70	2.513.412.685,40	2.549.467.663,25	2.869.455.593,90	2.869.455.593,90
C	**Total Net Cash Flows**	-1.666.406.555,00	140.523.524,70	218.996.125,40	297.468.724,25	993.913.043,90	993.913.043,90

Year	Expenditure	Revenue	Depreciation	Total Net Cash Flows	Present Value	PV Benefit	PV Cost	Initial Payback
0	-1.514.915.050,00	-	-151.491.505,00	-1.666.406.555,00	-1.666.406.555,00	(151.491.505,00)	1.514.915.050,00	1.666.406.555,00
1	-2.336.834.182,00	2.494.680.144,00	-151.491.505,00	140.523.524,70	125.467.432,77	2.211.926.523,84	2.086.459.091,07	1.525.883.030,30
2	-2.294.416.560,00	2.494.680.144,00	-151.491.505,00	218.996.125,40	174.582.370,38	2.003.677.204,56	1.829.094.834,18	1.306.886.904,90
3	-2.251.998.939,00	2.494.680.144,00	-151.491.505,00	297.468.724,25	211.732.362,26	1.814.660.725,14	1.602.928.362,88	1.009.418.180,65
4	-1.875.542.550,00	2.494.680.144,00	-151.491.505,00	993.913.043,90	631.649.707,76	1.823.590.905,10	1.191.941.197,34	15.505.136,75
5	-1.875.542.550,00	2.494.680.144,00	-151.491.505,00	993.913.043,90	563.972.953,36	1.628.206.165,27	1.064.233.211,91	-978.407.907,15

NPV	36.605.599,58	
IRR	13%	
Net B/C Ratio	1,00	
Payback Period	5,0	Years

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ATTACHMENT 10
SCENARIO 1 CALCULATION (VARIABLE COST RAISES 6%)

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No	Description	Year					
		0	1	2	3	4	5
A	**Cash Outflows**						
	1. Capital Expenditure (Shipbuilding Cost)	1.514.915.050,00					
	2. Operational Expenditure (Variable Cost)	-	1.893.404.860,00	1.893.404.860,00	1.893.404.860,00	1.893.404.860,00	1.893.404.860,00
	3. Fixed Installment	-	353.480.178,00	353.480.178,00	353.480.178,00	-	-
	4. Interest Installment	-	107.811.454,00	65.393.832,00	22.976.211,00	-	-
	Total Cash Outflows	1.514.915.050,00	2.354.696.492,00	2.312.278.870,00	2.269.861.249,00	1.893.404.860,00	1.893.404.860,00
B	**Cash Inflows**						
	1. Earning Before Tax	-	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00	2.494.680.144,00
	2. Earning After Tax	-	118.986.104,20	155.041.082,90	191.096.060,75	511.083.991,40	511.083.991,40
	3. Depreciation	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00
	Total Cash Inflows	-151.491.505,00	2.462.174.743,20	2.498.229.721,90	2.534.284.699,75	2.854.272.630,40	2.854.272.630,40
C	**Total Net Cash Flows**	-1.666.406.555,00	107.478.251,20	185.950.851,90	264.423.450,75	960.867.770,40	960.867.770,40

Year	Expenditure	Revenue	Depreciation	Total Net Cash Flows	Present Value	PV Benefit	PV Cost	Initial Payback
0	-1.514.915.050,00	-	-151.491.505,00	-1.666.406.555,00	-1.666.406.555,00	(151.491.505,00)	1.514.915.050,00	1.666.406.555,00
1	-2.354.696.492,00	2.494.680.144,00	-151.491.505,00	107.478.251,20	95.962.724,29	2.198.370.306,43	2.102.407.582,14	1.558.928.303,80
2	-2.312.278.870,00	2.494.680.144,00	-151.491.505,00	185.950.851,90	148.238.880,66	1.991.573.439,01	1.843.334.558,35	1.372.977.451,90
3	-2.269.861.249,00	2.494.680.144,00	-151.491.505,00	264.423.450,75	188.211.389,30	1.803.853.791,62	1.615.642.402,32	1.108.554.001,15
4	-1.893.404.860,00	2.494.680.144,00	-151.491.505,00	960.867.770,40	610.648.839,05	1.813.941.857,32	1.203.293.018,27	147.686.230,75
5	-1.893.404.860,00	2.494.680.144,00	-151.491.505,00	960.867.770,40	545.222.177,72	1.619.590.944,03	1.074.368.766,31	-813.181.539,65

NPV	-69.752.271,42	
IRR	11%	
Net B/C Ratio	0,992	
Payback Period	5,2	Years

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ATTACHMENT 11
SCENARIO 2 CALCULATION (INCOME DOWN 3%)

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No	Description	Year					
		0	1	2	3	4	5
A	**Cash Outflows**						
	1. Capital Expenditure (Shipbuilding Cost)	1.514.915.050,00					
	2. Operational Expenditure (Variable Cost)	-	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00
	3. Fixed Installment	-	353.480.178,00	353.480.178,00	353.480.178,00	-	-
	4. Interest Installment	-	107.811.454,00	65.393.832,00	22.976.211,00	-	-
	Total Cash Outflows	1.514.915.050,00	2.247.522.632,00	2.205.105.010,00	2.162.687.389,00	1.786.231.000,00	1.786.231.000,00
B	**Cash Inflows**						
	1. Earning Before Tax	-	2.419.839.739,68	2.419.839.739,68	2.419.839.739,68	2.419.839.739,68	2.419.839.739,68
	2. Earning After Tax	-	146.469.541,53	182.524.520,23	218.579.498,08	538.567.428,73	538.567.428,73
	3. Depreciation	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00
	Total Cash Inflows	-151.491.505,00	2.414.817.776,21	2.450.872.754,91	2.486.927.732,76	2.806.915.663,41	2.806.915.663,41
C	**Total Net Cash Flows**	-1.666.406.555,00	167.295.144,21	245.767.744,91	324.240.343,76	1.020.684.663,41	1.020.684.663,41

Year	Expenditure	Revenue	Depreciation	Total Net Cash Flows	Present Value	PV Benefit	PV Cost	Initial Payback
0	-1.514.915.050,00	-	-151.491.505,00	-1.666.406.555,00	-1.666.406.555,00	(151.491.505,00)	1.514.915.050,00	1.666.406.555,00
1	-2.247.522.632,00	2.419.839.739,68	-151.491.505,00	167.295.144,21	149.370.664,47	2.156.087.300,19	2.006.716.635,71	1.499.111.410,79
2	-2.205.105.010,00	2.419.839.739,68	-151.491.505,00	245.767.744,91	195.924.541,54	1.953.820.754,87	1.757.896.213,33	1.253.343.665,88
3	-2.162.687.389,00	2.419.839.739,68	-151.491.505,00	324.240.343,76	230.787.872,23	1.770.146.037,92	1.539.358.165,69	929.103.322,13
4	-1.786.231.000,00	2.419.839.739,68	-151.491.505,00	1.020.684.663,41	648.663.555,95	1.783.845.648,65	1.135.182.092,71	-91.581.341,28
5	-1.786.231.000,00	2.419.839.739,68	-151.491.505,00	1.020.684.663,41	579.163.889,24	1.592.719.329,15	1.013.555.439,92	-1.112.266.004,69

NPV	122.771.400,38	
IRR	14%	
Net B/C Ratio	1,02	
Payback Period	4,9	Years

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ATTACHMENT 12
SCENARIO 2 CALCULATION (INCOME DOWN 4%)

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No	Description	Year					
		0	1	2	3	4	5
A	**Cash Outflows**						
	1. Capital Expenditure (Shipbuilding Cost)	1.514.915.050,00					
	2. Operational Expenditure (Variable Cost)	-	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00	1.786.231.000,00
	3. Fixed Installment	-	353.480.178,00	353.480.178,00	353.480.178,00	-	-
	4. Interest Installment	-	107.811.454,00	65.393.832,00	22.976.211,00	-	-
	Total Cash Outflows	1.514.915.050,00	2.247.522.632,00	2.205.105.010,00	2.162.687.389,00	1.786.231.000,00	1.786.231.000,00
B	**Cash Inflows**						
	1. Earning Before Tax	-	2.394.892.938,24	2.394.892.938,24	2.394.892.938,24	2.394.892.938,24	2.394.892.938,24
	2. Earning After Tax	-	125.264.760,30	161.319.739,00	197.374.716,85	517.362.647,50	517.362.647,50
	3. Depreciation	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00
	Total Cash Inflows	-151.491.505,00	2.368.666.193,54	2.404.721.172,24	2.440.776.150,09	2.760.764.080,74	2.760.764.080,74
C	**Total Net Cash Flows**	-1.666.406.555,00	121.143.561,54	199.616.162,24	278.088.761,09	974.533.080,74	974.533.080,74

Year	Expenditure	Revenue	Depreciation	Total Net Cash Flows	Present Value	PV Benefit	PV Cost	Initial Payback
0	-1.514.915.050,00	-	-151.491.505,00	-1.666.406.555,00	-1.666.406.555,00	(151.491.505,00)	1.514.915.050,00	1.666.406.555,00
1	-2.247.522.632,00	2.394.892.938,24	-151.491.505,00	121.143.561,54	108.163.894,24	2.114.880.529,95	2.006.716.635,71	1.545.262.993,46
2	-2.205.105.010,00	2.394.892.938,24	-151.491.505,00	199.616.162,24	159.132.782,40	1.917.028.995,73	1.757.896.213,33	1.345.646.831,21
3	-2.162.687.389,00	2.394.892.938,24	-151.491.505,00	278.088.761,09	197.938.087,29	1.737.296.252,97	1.539.358.165,69	1.067.558.070,12
4	-1.786.231.000,00	2.394.892.938,24	-151.491.505,00	974.533.080,74	619.333.390,82	1.754.515.483,52	1.135.182.092,71	93.024.989,37
5	-1.786.231.000,00	2.394.892.938,24	-151.491.505,00	974.533.080,74	552.976.241,80	1.566.531.681,72	1.013.555.439,92	-881.508.091,37

NPV	-25.769.784,34	
IRR	11%	
Net B/C Ratio	0,997	
Payback Period	5,1	Years

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ATTACHMENT 13
SCENARIO 3 CALCULATION (COMBINATION 2%)

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No	Description	Year					
		0	1	2	3	4	5
A	**Cash Outflows**						
	1. Capital Expenditure (Shipbuilding Cost)	1.514.915.050,00					
	2. Operational Expenditure (Variable Cost)	-	1.821.955.620,00	1.821.955.620,00	1.821.955.620,00	1.821.955.620,00	1.821.955.620,00
	3. Fixed Installment	-	353.480.178,00	353.480.178,00	353.480.178,00	-	-
	4. Interest Installment	-	107.811.454,00	65.393.832,00	22.976.211,00	-	-
	Total Cash Outflows	1.514.915.050,00	2.283.247.252,00	2.240.829.630,00	2.198.412.009,00	1.821.955.620,00	1.821.955.620,00
B	**Cash Inflows**						
	1. Earning Before Tax	-	2.444.786.541,12	2.444.786.541,12	2.444.786.541,12	2.444.786.541,12	2.444.786.541,12
	2. Earning After Tax	-	137.308.395,75	173.363.374,45	209.418.352,30	529.406.282,95	529.406.282,95
	3. Depreciation	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00
	Total Cash Inflows	-151.491.505,00	2.430.603.431,87	2.466.658.410,57	2.502.713.388,42	2.822.701.319,07	2.822.701.319,07
C	**Total Net Cash Flows**	-1.666.406.555,00	147.356.179,87	225.828.780,57	304.301.379,42	1.000.745.699,07	1.000.745.699,07

Year	Expenditure	Revenue	Depreciation	Total Net Cash Flows	Present Value	PV Benefit	PV Cost	Initial Payback
0	-1.514.915.050,00	-	-151.491.505,00	-1.666.406.555,00	-1.666.406.555,00	(151.491.505,00)	1.514.915.050,00	1.666.406.555,00
1	-2.283.247.252,00	2.444.786.541,12	-151.491.505,00	147.356.179,87	131.568.017,74	2.170.181.635,60	2.038.613.617,86	1.519.050.375,13
2	-2.240.829.630,00	2.444.786.541,12	-151.491.505,00	225.828.780,57	180.029.321,25	1.966.404.982,92	1.786.375.661,67	1.293.221.594,56
3	-2.198.412.009,00	2.444.786.541,12	-151.491.505,00	304.301.379,42	216.595.711,25	1.781.381.955,82	1.564.786.244,56	988.920.215,13
4	-1.821.955.620,00	2.444.786.541,12	-151.491.505,00	1.000.745.699,07	635.991.983,65	1.793.877.718,21	1.157.885.734,56	-11.825.483,94
5	-1.821.955.620,00	2.444.786.541,12	-151.491.505,00	1.000.745.699,07	567.849.985,40	1.601.676.534,11	1.033.826.548,72	-1.012.571.183,01

NPV	58.596.843,12	
IRR	13%	
Net B/C Ratio	1,01	
Payback Period	5,0	Years

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ATTACHMENT 14
SCENARIO 3 CALCULATION (COMBINATION 3%)

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No	Description	Year					
		0	1	2	3	4	5
A	**Cash Outflows**						
	1. Capital Expenditure (Shipbuilding Cost)	1.514.915.050,00					
	2. Operational Expenditure (Variable Cost)	-	1.839.817.930,00	1.839.817.930,00	1.839.817.930,00	1.839.817.930,00	1.839.817.930,00
	3. Fixed Installment	-	353.480.178,00	353.480.178,00	353.480.178,00	-	-
	4. Interest Installment	-	107.811.454,00	65.393.832,00	22.976.211,00	-	-
	Total Cash Outflows	1.514.915.050,00	2.301.109.562,00	2.258.691.940,00	2.216.274.319,00	1.839.817.930,00	1.839.817.930,00
B	**Cash Inflows**						
	1. Earning Before Tax	-	2.419.839.739,68	2.419.839.739,68	2.419.839.739,68	2.419.839.739,68	2.419.839.739,68
	2. Earning After Tax	-	100.920.651,03	136.975.629,73	173.030.607,58	493.018.538,23	493.018.538,23
	3. Depreciation	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00	-151.491.505,00
	Total Cash Inflows	-151.491.505,00	2.369.268.885,71	2.405.323.864,41	2.441.378.842,26	2.761.366.772,91	2.761.366.772,91
C	**Total Net Cash Flows**	-1.666.406.555,00	68.159.323,71	146.631.924,41	225.104.523,26	921.548.842,91	921.548.842,91

Year	Expenditure	Revenue	Depreciation	Total Net Cash Flows	Present Value	PV Benefit	PV Cost	Initial Payback
0	-1.514.915.050,00	-	-151.491.505,00	-1.666.406.555,00	-1.666.406.555,00	(151.491.505,00)	1.514.915.050,00	1.666.406.555,00
1	-2.301.109.562,00	2.419.839.739,68	-151.491.505,00	68.159.323,71	60.856.539,02	2.115.418.647,95	2.054.562.108,93	1.598.247.231,29
2	-2.258.691.940,00	2.419.839.739,68	-151.491.505,00	146.631.924,41	116.894.072,39	1.917.509.458,23	1.800.615.385,84	1.451.615.306,88
3	-2.216.274.319,00	2.419.839.739,68	-151.491.505,00	225.104.523,26	160.224.953,35	1.737.725.237,35	1.577.500.284,00	1.226.510.783,63
4	-1.839.817.930,00	2.419.839.739,68	-151.491.505,00	921.548.842,91	585.660.949,80	1.754.898.505,29	1.169.237.555,49	304.961.940,72
5	-1.839.817.930,00	2.419.839.739,68	-151.491.505,00	921.548.842,91	522.911.562,32	1.566.873.665,44	1.043.962.103,11	-616.586.902,19

NPV	-196.302.212,60	
IRR	8%	
Net B/C Ratio	0,98	
Payback Period	5,3	Years

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The author named Mochammad Grizhaldo Azranda Junior was born in Yogyakarta, September 24th, 1995. The author studied Elementary School at SD Muhammadiyah Kauman Yogyakarta in 2001, Junior High School at SMPN 8 Yogyakarta in 2007 and Senior High School at SMAN 6 Yogyakarta in 2010. Then the author continued the education at Department of Marine Engineering Double Degree, Institut Teknologi Sepuluh Nopember - Hochschule Wismar in 2013 with registered number 4213101036. During the lecture, the author became part of the Student Executive Board in the Faculty of Marine Technology, had been a Head of Training Division under Human Resource and Development Department in 2016. On the Job Training experience has already done in PT. Bandar Abadi Shipyard (Batam, Riau Island) and PT. Pertamina Shipping Persero (Tanjung Priok, DKI Jakarta). In the 3 years of study, the author joined with the reliability, availability, maintenance, and safety (RAMS) laboratory and completed studies in 8 semesters.

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